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C. Title
PROPOSED PLAN FOR THE 200-TW-1, 200-TW-2, AND 200-PW-5 OPERABLE UNITS, DRAFT A

* Per DOE-RL comments - 3/25/2004 J. Aardal

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Draft A
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Proposed Plan for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Approved for Public Release
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March 2004

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Project Hanford Management Contractor for the
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Janis Aardal
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United States
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United States
Environmental Protection
Agency

Washington State
Department of Ecology

DOE/RL-2004-10, DRAFT A

PROPOSED PLAN FOR THE

THE 200-TW-1 SCAVENGED WASTE GROUP, THE 200-TW-2 TANK WASTE GROUP, AND 200-PW-5 FISSION PRODUCT-RICH WASTE GROUP OPERABLE UNITS

HANFORD SITE

RICHLAND, WASHINGTON

MARCH 2004

INTRODUCTION

Environmental cleanup (remedial action) is needed at the 200-TW-1 Scavenged Waste Group Operable Unit, the 200-TW-2 Tank Waste Group Operable Unit, and the 200-PW-5 Fission Product-Rich Waste Group Operable Unit. The cleanup is needed to reduce risks to human health and the environment that are posed by contaminated soil and debris.

Remedial action for the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites, shown in Figures 1 through 6 (at the end of the Proposed Plan), is required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), also known as Superfund, and by the *Resource Conservation and Liability Act of 1976* (RCRA). This document presents the Proposed Plan for the soil waste sites and associated structures. This document describes five cleanup alternatives and identifies the preferred remedies for the waste sites.

In presenting the remedial alternatives and preferred remedies for these waste sites, this plan references or highlights key information that can be found in greater detail in the *Feasibility Study for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units* (DOE/RL-2003-64) and other documents contained in the Administrative Record file. These documents may be reviewed to gain a more comprehensive understanding of the history, previous studies, and site descriptions that influence the selection of remedial alternatives and remedies. This Proposed Plan, which serves as the public notice required by both CERCLA and RCRA, is issued by the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the U.S. Department of Energy (DOE). These three agencies—collectively known as the Tri-Parties— are proposing the preferred alternatives for these waste sites under the authority of CERCLA and RCRA and in accordance with the *Hanford Federal Facility Agreement and Consent Order*, also known as the Tri-Party Agreement

HOW YOU CAN PARTICIPATE

The Tri-Parties are issuing this document as part of the public participation responsibilities under Section 117(a) of CERCLA. Final remedies will be selected only after the public comment period has ended and the comments received have been reviewed and considered. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this document. If requested, the Tri-Parties will hold a public meeting to explain the content of this Proposed Plan and to obtain comments. Responses to comments will be presented in a responsiveness summary that will be part of the Record of Decision.

The "Community Participation" section of this document provides dates for the public review period and other information regarding public involvement.

Proposed Plan
The plan that presents the preferred alternatives for remedial action of waste sites to the public by the responsible parties. The proposed plan is developed based on the results of feasibility studies performed on the waste sites.

CERCLA
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as Superfund.

Waste Sites
Sites that are contaminated or potentially contaminated from past operations. Contamination may be contained in environmental media, such as soil or groundwater, or in man-made structures or solid waste, such as debris.

RCRA
Resource Conservation and Recovery Act of 1976.

Feasibility Study
The CERCLA document used to evaluate potential remedial alternatives that could be used to address contamination problems.

Administrative Record
The files containing all the documents used to select a response action at a CERCLA remedial action site.

Remedial alternative
General or specific actions that are evaluated to determine the extent to which they can eliminate or minimize threats posed by contaminants to human health and the environment.

(Ecology et. al. 1989). The DOE is also issuing this Proposed Plan as part of its responsibility under the *National Environmental Policy Act of 1969* (NEPA).

The Tri-Party Agreement addresses the need for the cleanup programs to integrate the requirements of CERCLA and RCRA to provide a standard approach to direct cleanup activities and to ensure that applicable regulatory requirements are met. Details of this integration are provided in Section 5.5 of the Tri-Party Agreement.

EPA
U.S. Environmental Protection Agency

Ecology
Washington State Department of Ecology

DOE
U.S. Department of Energy

NEPA
National Environmental Policy Act of 1969. A Federal law that establishes a program to prevent and eliminate damage to the environment.

Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)
An agreement and consent order between DOE, EPA, and Ecology that details the process to be used to address CERCLA, RCRA, and state requirements for cleaning up the Hanford Site.

BC Cribs and Trenches Area
A series of 200-TW-1 and 200-LW-1 Operable Unit waste sites located south of the 200 East Area; includes 6 cribs, 20 trenches, a siphon tank, and a portion of pipeline from the cribs to Route 4 South (see Figure 3).

Overview of the Proposed Plan

This plan proposes remedial actions for 41 different waste sites that are in the 200-TW-1 Operable Unit, including four waste sites that were originally in the 200-LW-1 300 Area Chemical Laboratory Waste Group Operable Unit that were reassigned to the 200-TW-1 Operable Unit to facilitate remedial action in the BC Cribs and Trenches Area; 29 waste sites in the 200-TW-2 Operable Unit; and 9 waste sites in the 200-PW-5 Operable Unit (Figures 2 through 6). These waste sites consist of liquid waste disposal sites including cribs, trenches, french drains, unplanned release sites, underground settling and siphon tanks, injection/reverse wells, and one underground pipeline.

For these waste sites, this Proposed Plan presents "source control" cleanup actions: in other words, actions that reduce risks by mitigating the source of the contamination. To identify preferred remedies, the Tri-Parties first evaluated the following range of alternatives:

- Alternative 1 – No Action
- Alternative 2 – Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation
- Alternative 3 – Removal, Treatment, and Disposal
- Alternative 4 – Capping
- Alternative 5 – Partial Removal, Treatment, and Disposal with Capping.

Given the varying nature and extent of the contamination at the different waste sites, no single alternative could be applied to all of them. As discussed later in this document, Alternatives 2, 3, and 4 have been identified as preferred alternatives to remediate different waste sites.

The remediation of contaminated groundwater that may be beneath the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units will be addressed by the four groundwater operable units at the Hanford Site (200-UP-1 and 200-ZP-1 Operable Units in the 200 West Area and the 200-BP-5 and the 200-PO-1 Operable Units in the 200 East Area.

The combined present-value cost for implementation of the preferred alternatives is estimated to be approximately $194 Million. This estimate is based on a feasibility study-level estimate (refined cost estimates will be prepared based on the results of additional sampling and the remedial design; these refined costs will be included in the remedial design report/remedial action work plan to be generated later). Individual present-value costs for each of the waste sites are provided in Appendix A.

The following sections of the Proposed Plan provide information regarding:

- The history of the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units
- The scope and role of the proposed actions, including strategies used to characterize the waste sites, and regulatory requirements and goals for the remedial actions
- Site risks
- Summaries and evaluations of remedial alternatives
- The preferred alternatives for the different waste sites
- Community participation.

SITE BACKGROUND

Hanford Site

The Hanford Site (Figure 1) is a 1,517 km^2 (586-mi^2) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1989, the primary mission of the Hanford Site was the production of nuclear materials for national defense. In July 1989, the 100, 200, 300, and 1100 Areas of the Hanford Site were placed on the National Priorities List (NPL) (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B) pursuant to CERCLA.

200 Areas

The 200 Areas are located in the central portion of the Hanford Site and are divided into three main areas: 200 East Area, 200 West Area, and 200 North Area. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes in the 200 Areas routed high-activity waste streams to systems of large underground tanks called "tank farms." The liquid wastes were evaporated (concentrated) and often neutralized before being routed to the tanks. The storage tanks were used to allow settling of the heavier constituents from the liquid effluents, forming sludge. The liquid wastes in the tanks ultimately were discharged to the soil column via cribs, drains, trenches, and injection/reverse wells. Other wastes and drainages also were sent to cribs and trenches via this underground network. Lower activity liquid wastes were discharged to trenches, cribs, drains, and ponds, many of which were unlined. The 200 North Area formerly was used for interim storage and staging of irradiated fuel.

The 200-TW-1 Operable Unit waste sites received scavenged waste from the Uranium Recovery Project and the ferrocyanide processes at the 221/224-U Plant, which recovered the uranium from the metal waste streams at the B and T Plants. The scavenged waste discharges contributed perhaps the largest liquid fraction of contaminants to the ground in the 200 Areas. Three of the 200-LW-1 waste sites included in this feasibility study (216-B-53B, 216-B-54, 216-B-58 Trenches) received waste from the 300 Area laboratory facilities and the 340 Facility. The other 200-LW-1 waste site (216-B-53A Trench) received waste from the Plutonium Recycle Test Reactor, including an estimated 100 grams of plutonium. The 200-TW-2 waste sites received tank waste from first- and second-cycle decontamination processes associated with the bismuth-phosphate process at the B and T Plants. The tank wastes contained inorganic anions and cations as well as low levels of radionuclides. The 200-PW-5 Operable Unit waste sites received fission-product-rich wastes that were generated during the fuel-rod enrichment cycle and then released when the fuel elements were dissolved in sodium hydroxide or nitric acid. The sites in this group generally received more than 20 curies of fission products (e.g., cesium-137 or strontium-90) and contained smaller quantities of plutonium, uranium, and organic wastes than the sitesin the plutonium, uranium, or organic-rich groups. Most of the waste streams in this group were low-salt neutral/basic, although the 216-B-50 and 216-B-57 Cribs contained some inorganic compounds.

Comprehensive descriptions of the waste sites and all of the alternatives considered in this plan are provided in greater detail in the feasibility study (DOE/RL-2003-64).

NPL
National Priorities List. A list of top-priority hazardous waste sites in the United States that are eligible for investigation and cleanup under Superfund (40 CFR 300, Appendix B).

CFR
Code of Federal Regulations

Crib
An underground structure designed to receive liquid waste that can percolate into the soil directly.

Injection/Reverse Well
A well (sometimes drilled into the water table) designed to receive liquid wastes that percolate into the vadose zone at greater depths than cribs and trenches.

Waste sites within the 200 Areas have been characterized through a series of three investigations. (1) A scoping-level investigation (such as the B Plant Source Aggregate Area Management Study Report [DOE/RL-92-05]). (2) A remedial investigation (such as the Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit) [DOE/RL-2002-42]). (3) The application of the analogous sites approach in the feasibility study (DOE/RL-2003-64). All of the representative sites have been sampled; several other waste sites have been sampled; and the remaining sites have been characterized through process knowledge and the analogous site approach.

Characterization
Identification of the characteristics of a site through review of existing site information and/or sampling and analysis of environmental media and materials, to determine the nature and extent of contamination so that informed decisions can be made regarding the level of risk presented by the site, and the protective remedial action that is needed.

Analogous Site Approach
Facilities can have many source waste sites that are geologically similar, have similar process and waste disposal histories, and have similar contaminant inventories. In these situations, the analogous site approach can be used to reduce the amount of site characterization and evaluation required to support remedial action decision making. Within each group of similar sites, a representative site(s) is selected for comprehensive field investigations, including sampling and analyses. Findings from site investigations at representative sites are used to develop a conceptual site model, which is applied to other "analogous" sites that were not sampled. The nature and extent of contamination at unsampled analogous sites is assumed to be similar to the nature and extent of contamination described by the conceptual site model for the representative site(s) that was sampled. Available site-specific information for the analogous sites is considered in evaluating these sites against the representative sites. Confirmatory sampling is completed before the remedial action is designed, to confirm the accuracy of the site conceptual model with respect to the unsampled analogous site.

Analogous Site
A waste site in an operable unit that is analogous to a representative site because of similar waste disposal practices, construction, geology, volumes of effluent received, contaminant inventories, and other factors.

SCOPE AND ROLE OF ACTION

This Proposed Plan presents remedial actions for contaminated soil, structures (such as concrete, tanks), and debris (such as timbers) associated with liquid-waste disposal sites with the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units. The proposed remedial actions reduce potential threats to human health and the environment from waste site contaminants. Other than the requirement for the source control action to be protective of groundwater, the scope of this plan does not include remediation of groundwater that may be beneath these waste sites.

The scope and role, including identifying strategies and determining the requirements, limits, and goals for cleanup, are key elements of the action. These elements are discussed in the sections below. A key component of the overall strategy for actions in these operable units includes cleanup of waste sites, structures, and pipelines that represent some of the more highly contaminated waste sites at the Hanford Site. Measures will be employed to focus on addressing sites that pose a high-risk to groundwater and sites that are consistent with actions in associated contiguous areas in a cost effective and integrated manner.

Analogous Site Approach

The characterization of the waste sites discussed in this plan employed the use of a streamlining process, called the analogous site approach. As detailed in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (Implementation Plan), the analogous site approach streamlines the risk investigation process through the development of conceptual site models. Generated from sampling and analysis data for the representative sites, the conceptual site models form a basis for estimating risks and evaluating remedial alternatives for other waste sites. Thus, the waste sites identified in this Proposed Plan either have been sampled directly or were evaluated with the use of conceptual site models from representative sites that were sampled. However, additional sampling data will be collected concurrently with or after the Record of Decision (ROD) for these waste sites:

- Waste sites where removal, treatment, and disposal was selected as the preferred remedy - data collection will occur using an observational approach; samples will be taken from the open excavation as the removal progresses
- Waste sites where capping was selected as the preferred alternative - data collection will be conducted to support design activities as well as to confirm the site conceptual model
- Waste sites where partial removal, treatment, and disposal with capping was selected as the preferred remedy – data collection will occur using an observational approach; samples will be taken from the open excavation as the removal progresses. Additional data collection may be conducted as necessary to support design activities for the capping portion of the alternative

- Waste sites where maintain existing soil cover, institutional controls, and monitored natural attenuation was selected as the preferred remedy - data collection will be conducted to confirm the site conceptual model
- Waste sites where no action was selected as the preferred remedy - data collection will be conducted to verify that remediation goals have been met and that residual risk is at acceptable levels.

Representative Waste Sites and Conceptual Site Models

The conceptual site models used to characterize the waste sites evaluated in this plan were developed from sampling data taken from representative waste sites. The representative sites include the 216-B-46 Crib, the 216-T-26 Crib, the 216-B-5 Injection/Reverse Well, the 216-B-7A Crib, the 216-B-38 Trench, the 216-B-57 Crib, and the 216-B-58 Trench.

Table 1 identifies the representative sites, the analogous sites, and the rationale for applying the representative waste sites conceptual models to the analogous site. Appendix B provides summary information for all the waste sites.

Land Use

Part of the scope for the evaluations presented in this document involved calculating the site risks on the basis of the reasonably anticipated future land use for the Central Plateau of the Hanford Sites, which includes the 200 Areas. Alternatives must meet the requirements of the following anticipated land uses:

- Industrial-exclusive use for the next 50 years (through 2050) inside the core zone.
- Industrial land use (non-DOE worker) after the next 50 years inside the core zone.
- Native American uses consistent with treaty rights beginning in 2150.
- No consumptive use of groundwater for the next 150 years.

In addition, risks were calculated considering the possibility of intruders beginning 150 years from now (2150) because of the increasingly possible loss of institutional control after that date. All the waste sites in these operable units are within the core zone.

These human risk exposure scenarios are consistent with the Hanford Advisory Board Advice #132 (available at http://www.hanford.gov/boards/hab/advice/habadv-132.pdf). The scenarios also are consistent with the Tri-Party's identification of the use of a 150-year time frame in their response to the Hanford Advisory Board Advice #132 (Klein et al. 2002, "Consensus Advice #132: Exposure Scenario Task Force on the 200 Area).

The DOE is expected to continue industrial-exclusive activities for at least 50 years, in accordance with DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (CLUP-EIS), and 64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement."

Applicable or Relevant and Appropriate Requirements

Applicable or relevant and appropriate requirements (ARARs) are those cleanup standards, standards of control, and other substantive environmental

ROD
Record of Decision. The formal document under CERCLA or NEPA in which the lead regulatory agency sets forth the selected remedial measure and provides the reasons for its selection.

Confirmatory Sampling
Sampling before or after the Record of Decision, but before the remedial design is completed, to confirm the accuracy of the conceptual site model used for remedial decision making.

CLUP-EIS
Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement – DOE/EIS-0222-F

Industrial-exclusive
A land-use designation under the CLUP-EIS that applies to the 200 Areas core zone. Under this land-use designation, waste management activities would continue. This land use assumes an industrial worker scenario. This is an exposure scenario where the receptor works onsite on a full-time basis (that is, the worker spends 2,000 hours per year over the duration of his or her entire career). The designation assumes the land-use at the 200 Area exposure pathways evaluated include direct exposure to radiation, incidental ingestion of soil, and inhalation of resuspended dust and volatile constituents (exposure to groundwater is not considered).

ARAR
Applicable or relevant and appropriate requirements. These cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, or address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well- suited to the particular site.

Table 1. Conceptual Models, Analogous Sites, and Rationale for Application

Representative Site Conceptual Model	Analogous Sites	Rationale	Further Information in Appendix B
216-B-46 Crib	216-B-14 through 216-B-19 Cribs; 216-B-20 through 216-B-34 Trenches; 216-B-42 Trench; 216-B-43 through 216-B-45 Cribs; 216-B-47 through 216-B-49 Cribs; 216-B-52 Trench	♦ The waste sites all received scavenged waste from the Uranium Recovery Process in U Plant. ♦ The contaminant distribution is very similar between the 216-B-46 Crib and the analogous sites with data (216-B-43, 216-B-44, 216-B-45. 216-B-47, 216-B-48, 216-B-49, 216-B-26). Because the waste sites all received a similar volume and contaminant load, all the other analogous sites in this group are expected to have contaminant distributions similar to the 216-B-46 Crib.	Table B-1
	216-BY-201 Settling Tank; 200-E-14 Siphon Tank	♦ The waste sites received similar waste (i.e., scavenged waste from the Uranium Recovery Process) ♦ The contaminant distribution is expected to be much higher for the 216-B-46 Crib, because the crib was designed to discharge liquid wastes to the soil, while the 216-BY-201 Settling Tank and 200-E-14 Siphon Tank were designed to hold and transfer waste.	
	216-B-51 French Drain	♦ The waste sites both received scavenged waste. ♦ The contaminant distribution is expected to be much higher at the crib because it received 3 orders of magnitude more waste than the french drain.	
	200-E-114 Pipeline	♦ The waste sites received the same waste; the pipeline was used to transfer scavenged waste to the BC Cribs and Trenches. ♦ The contaminant distribution is expected to be much higher at the crib, because it was designed to discharge wastes, while the pipeline was designed to transfer wastes.	
	UPR-200-E-9	♦ The waste sites both received scavenged waste. ♦ The contaminant distribution is expected to be much higher at the crib, because it received 2 orders of magnitude more waste than the unplanned release.	
216-T-26 Crib	216-T-18 Crib	♦ Both cribs received scavenged waste from the Uranium Recovery Process. ♦ 216-T-26 Crib may contain transuranic constituents above 100 nanocuries per gram. ♦ The contaminant distribution is expected to be somewhat more shallow at the 216-T-26 Crib because a lesser volume of effluent was discharged.	Table B-1
216-B-5 Injection/Reverse Well	216-T-3 Injection/Reverse Well	♦ The waste sites received similar waste (i.e., liquid waste from the 221-B or –T and 224-B- or –T buildings through the 241-B-361 or 241-T-361 Settling Tanks) ♦ The contaminants distribution and contaminant types are expected to be similar, with contaminants at the 216-T-3 Injection/Reverse Well located higher in the vadose zone. Wastes were injected from 74 to 86.6 m (243 to 284 ft) below ground surface at 216-B-5 and from 32 to 62 m (105 to 204 ft) at 216-T-3.	Table B-2
216-B-7A Crib	216-B-7B, 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs; 216-T-5 Trench; 200-E-45 Sampling Shaft	♦ The waste sites received similar waste (i.e., 2nd cycle waste, cell 5-6 drainage, and lanthanum fluoride waste) ♦ The contaminant distributions for these sites are expected to be similar to or slightly less than the 216-B-7A Crib, because these sites received similar or slightly less volumes of effluent and inventories.	Table B-2
	UPR-200-E-7	♦ The waste sites received the same waste. The unplanned release occurred in a pipeline from 221-B to the 216-B-9 Crib, which is the same waste that went to 216-B-7A Crib. ♦ The contaminant distribution is expected to be near the surface, because only a small volume was released.	
	241-B-361 and 241-T-361 Settling Tanks	♦ The settling tanks received the same waste. ♦ The contaminant distribution is expected to be much higher at the crib because it was designed to discharge wastes, while the settling tanks were designed to transfer wastes. The tanks did, however, accumulate solids from that waste.	
216-B-38 Trench	216-B-35 through 216-B-37 and 216-B-39 through 216-B-41 Trenches; 216-T-14 through 216-T-17 and 216-T-21 through 216-T-25 Trenches	♦ The waste sites received similar waste (i.e., 2nd cycle waste, cell 5-6 drainage, and lanthanum fluoride waste) ♦ The contaminant distributions for these sites are expected to be similar to the 216-B-38 Trench contaminant distribution, because they were similarly constructed and received similar effluent volumes.	Table B-2
216-B-57 Crib	216-B-50, 216-B-62, 216-C-6, 216-S-9, and 216-S-21 Cribs	♦ The waste sites received similar waste types (i.e., process condensates) ♦ The contaminant distributions for these sites are expected to be similar to the 216-B-57 Crib, because of the large volumes of effluent discharged.	Table B-3
	216-B-11A and 216-B-11B French Drains	♦ The waste sites received the same waste. ♦ The contaminant distribution for these sites is expected to be similar to the 216-B-57 Crib; however, contaminants were discharged at 12 m (40 ft) below ground surface, deeper than the crib.	
	UPR-200-W-108 and UPR-200-W-109	♦ The waste sites received unplanned releases of effluents associated with the 216-S-9 Crib, which is analogous to the 216-B-57 Crib. ♦ The contaminant distributions for these sites are expected to be generally near the surface because of the relatively small volume of effluent discharged.	
216-B-58 Trench	216-B-53A Trench	♦ The waste site received liquid waste associated with the PRTR reactor process tube failure. This waste site received 100 grams of plutonium. This waste site has been identified as potentially containing transuranic constituents above 100 nanocuries per gram. ♦ The contaminant distributions for these sites are expected to be similar because of similar construction and waste volumes.	Table B-1
	216-B-53B and 216-B-54 Trenches	♦ The waste sites received the same waste (i.e., 300 Area laboratory waste) ♦ The contaminant distributions for these sites are expected to be similar because of similar construction and waste volumes discharged.	

protection requirements, criteria, or limitations activated into law under Federal or state law that:

- Specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site
- Address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

The feasibility study addresses the ARARs for the waste sites in detail. As discussed below, these ARARs are incorporated into the remedial action objectives (RAO) and preliminary remediation goals (PRG) that drive the evaluation of alternatives and the selection of preferred remedies.

Key ARARs identified for the remedy of these waste sites include:

- Washington Administrative Code (WAC) 173-340-745, "Soil cleanup standards for industrial properties"
- WAC 173-340-747, "Deriving soil concentrations for ground water protection evaluations."

Remedial Action Objectives

The RAOs for the waste sites were developed with consideration of reasonably anticipated future land use, conceptual site models, ARARs, and worker safety. The following RAOs were identified:

- RAO 1 - Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents at concentrations above the industrial use criteria as defined in WAC 173-340-745(5) for human health, or the screening criteria in WAC 173-349-900, Table 749-3, for ecological receptors; prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents at concentrations above 15 mrem/yr[1] (OSWER Directive 9200.4-31P, EPA/540/R-99/006, *Radiation Risk Assessment at CERCLA Sites: Q&A*) under an industrial use scenario for humans or the screening criteria for ecological receptors based on an acceptable dose of 0.1 rad/d (DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terretrial Biota*).
- RAO 2 - Prevent migration of contaminants through the soil column to groundwater or reduce soil concentrations below WAC 173-340-747 groundwater protection values such that no further degradation of the groundwater occurs caused by leaching from soils or debris in the waste sites.
- RAO 3 - Minimize the general disruption of cultural resources and wildlife habitat and prevent adverse impacts to cultural resources and threatened or endangered species during remediation.

The above RAOs were used to develop the preliminary remediation goals discussed below, and will be finalized in the Record of Decision.

Preliminary Remediation Goals

As described in the feasibility study, PRGs were developed for a comprehensive list of constituents to establish residual soil concentrations for individual contaminants that are protective of human health and the environment

[1] A dose limit of 15 mrem/year generally will achieve the U.S. Environmental Protection Agency excess lifetime cancer risk threshold, which ranges between $1x10^{-4}$ to $1x10^{-6}$.

Core Zone
The area in the middle of the Central Plateau that contains the current and future waste management activities (see Figure 1).

PRG
Preliminary remediation goals. These are initial cleanup levels that are developed during the CERCLA decision-making process. PRGs may be refined in the Record of Decision to become final cleanup levels (that is, the remediation goals). A complete discussion of the PRGs is presented in the feasibility study (DOE/RL-2003-64).

WAC
Washington Administrative Code

RAO
Remedial action objectives. These are general descriptions of what the remedial action will accomplish (such as prevent contaminant migration).

COPC
Contaminant of potential concern. The list of all hazardous substances potentially present at a waste site. The COPCs are evaluated to screen out chemicals that are unlikely to be a threat (because of persistence or abundance), to develop a list of COCs (see below).

COC
Contaminants of concern. A list of radioactive and/or chemical constituents that are a risk to human health or the environment. The COC list is developed from the COPC list (see above), and is typically the list of chemicals and radionuclides that the environmental samples are analyzed for and that the remedial decisions are designed to protect against.

at a generic waste site. The feasibility study screening process compared the observed constituent concentrations at the waste sites to the following concentrations:

- Naturally occurring levels
- Radiological dose exposure limits
- Cleanup levels consistent with WAC 173-340-745 and WAC 173-340-747
- Screening levels consistent with WAC 173-340-900, Table 749-3.

Table 2 summarizes the PRGs for the contaminants of potential concern (COPC) evaluated and the contaminants of concern (COC) retained as part of this Proposed Plan. After public comment, the PRGs will be issued in the Record of Decision for these waste sites as remediation goals or cleanup levels. Only those constituents that exceed one or more of these criteria were retained as COCs.

TABLE 2. SUMMARY OF SOIL PRELIMINARY REMEDIATION GOALS.

Constituent	Overall PRG [a] (mg/kg)	Constituent	Overall PRG [a] (mg/kg)
Contaminants of Potential Concern/Contaminants of Concern			
Aroclor-1254	0.65	Vanadium	2,240
Aluminum	11,800	Zinc	360
Antimony	5.4	Benzoic acid	257
Barium	132	Bis(2-ethylhexyl)phthalate	14
Cadmium	1.0	Butylbenzylphthalate	893
Chromium	67	Diethylphthalate	72
Copper	217	Di-n-butylphthalate	11
Cyanide	0.8	Di-n-octylphthalate	532,000
Fluoride	16	Dichlorodiphenyltrichloroethane	3.5
Lead	118	Isophorone	0.45
Manganese	512	Pentachlorophenol	0.012
Mercury	2.1	Phenol	44
Nickel	130	2-Butanone	22
Nitrate (as nitrogen)	40	2-Hexanone	0.0048
Nitrate (as nitrogen)	4	1,1,1,-Trichloroethane	1.6
Selenium	0.78	Acetone	3.2
Silver	13.6	Methylene Chloride	0.025
Sulfate	1,000	Styrene	0.033
Thallium	38	Toluene	7.3
Uranium	3.21		
Americium-241	335	Radium-228	8.15
Cesium-137	20	Strontium-90	20
Cobalt-60	4.90	Technetium-99	b
Neptunium-237	59.2	Thorium-228	7.73
Nickel-63	3,070,000	Thorium-232	4.8
Plutonium-238	47	Tritium	b
Plutonium-239/240	425	Uranium-233/234	b
Potassium-40	76.4	Uranium-235	b
Radium-226	7.03	Uranium-238	b

a. Listed values represent the most restrictive soil PRG derived from evaluation of direct contact, groundwater protection, and terrestrial wildlife protection per the feasibility study (DOE/RL-2003-64).
Shading indicates contaminants of concern. Unshaded constituents are contaminants of potential concern, which were eliminated from concern through the risk assessment process; these are provided for informational purposes only.
b. Constituent is considered mobile. The protection of groundwater is evaluated using fate and transport modeling based on site-specific conditions. The PRG is the most conservative for the different exposure pathways. The protection of groundwater is likely the PRG for this constituent if it impacts groundwater.
pCi/g = picocurie / gram.

Numeric soil PRGs were developed independently for the protection of human health, the protection of ecological receptors, and the protection of groundwater. These PRGs, which were based on generic site parameters, were then compared to each other to identify the most restrictive value and select a PRG that is protective of all pathways.

Based on historical 200 Areas operations and characterization information, a comprehensive list of potential contaminants was identified for the waste sites. Although PRGs were developed for each of the potential contaminants, it should be emphasized that these contaminants will not necessarily be found at each waste site. Some of the potential contaminants may not be found at any of the waste sites.

SUMMARY OF REMEDIATION OBJECTIVES

The human health and ecological risk assessments, which are fundamental to the scope and role of the actions in this Proposed Plan, were performed in accordance with the Tri-Parties response to the Hanford Advisory Board advice #132 (Klein et al. 2002), with EPA guidance for conducting human health and ecological risk assessments, and with DOE/RL-91-40, *Hanford Past-Practice Strategy*. The past-practice strategy approach focuses the pre-remediation studies, such as remedial investigations (RI), so that more resources can be allocated to the cleanup of waste sites. A conceptual site model was developed for the representative sites. Potential risks to human health and ecological receptors were evaluated in a risk assessment for the representative sites, as documented in the feasibility study (DOE/RL-2003-64).

The Tri-Parties believe that remedial action is necessary at the waste sites addressed by this plan to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release, or threat of release, may present an imminent and substantial danger to public health, welfare, or the environment.

SUMMARY OF SITE RISKS

Risks were estimated based on the RAOs and in accordance with the Tri-Party response to Hanford Advisory Board advice #132 (Klein et al. 2002, "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area"). The HAB advice was prepared subsequent to a series of Tri-Party- and HAB-sponsored public workshops. The Tri-Parties agreed to assess risks for the core zone of the 200 Areas using an industrial exposure scenario. The exposure scenario includes the assumption that groundwater under the 200 Areas will not be used for a minimum of 150 years.

Findings of the risk evaluations indicate the following.

- Radionuclide contaminants (the most prevalent are cesium-137 and strontium-90) associated with three of the representative waste sites exceed the criteria for the target dose of 15 mrem/year. Two of the analogous sites with characterization data have radionuclides that exceed the target dose of 15 mrem/year.

RI
Remedial Investigation. A data collection activity under CERCLA that includes sampling and analysis to identify the nature and extent of contaminants at a waste site.

Representative sites 216-B-38 Trench, 216-B-57 Crib, and 216-B-58 Trench have radiological contamination in the 0 to 4.6 m (0 to 15-ft) zone that exceeds the 15 mrem/yr target dose.

Analogous sites 216-B-47 Crib and 216-B-26 Trench have radiological contamination in the 0 to 4.6 m (0 to 15-ft) zone that exceeds the 15 mrem/yr target dose.

Human Health Risk
Human health risk is evaluated in the feasibility study using an industrial land-use scenario. Risks are evaluated using contaminants in the soil from the ground surface to 4.6 m (15 ft) below the ground surface. This evaluation is in accordance with regulations and provides a conservative estimate of the subsurface zone that may be encountered by industrial users.

The 216-B-43 through 216-B-45 and 216-B-47 through 216-B-50 Cribs, and the 216-B-26 Trench have data available for risk analysis. All these analogous sites exceeded groundwater protection standards. These same waste sites also had intruder dose rates above 15 mrem/yr at 150 years.

Representative sites 216-B-7A Crib, 216-B-38 Trench, 216-B-57 Crib, and 216-B-58 Trench and analogous sites 216-B-47 Crib and 216-B-26 Trench exceeded ecological screening levels for radionculides.

Groundwater Protection Risk Evaluation
Groundwater protection is evaluated for contaminants in the soil from the ground surface to the water table. This evaluation uses fate and transport modeling and comparison to risk-based standards to assess the potential for contaminants in the vadose zone to continue to impact groundwater or to impact groundwater in the future.

Ecological Risk Assessment
Ecological risk is evaluated for contaminants in the soil from the ground surface to 4.6 m (15 ft) deep. In the feasibility study, the contaminant concentrations in this zone are compared to risk-based screening levels.

Inadvertent Intruder Scenario
An exposure scenario in which the receptor (future rural residential intruder) resides within the waste site area and has planted a garden using the drill cuttings taken from a borehole drilled in that area. The scenario assumes that after 150 years of institutional controls, the intruder could unknowingly obtain access to the waste site area. Exposure pathways evaluated include direct exposure to radiation, ingestion of soil and garden produce, and inhalation of resuspended dust.

- Nonradionuclide contaminants in and around the representative waste sites are less than the industrial use criteria as defined in WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels."
- Groundwater protection values (as identified in WAC 173-340-747) are exceeded for nonradionuclides and radionuclides at all of the representative waste sites. For the analogous sites with data, eight had contamination concentrations that exceeded groundwater protection standards for both nonradionuclides and radionuclides.
- Ecological evaluations indicate that radiological constituents (cesium-137 and strontium-90) exceed the ecological screening values for terrestrial wildlife populations at four of the representative waste sites; none of the nonradiological constituents present in the 0 to 4.6 m (0 to 15-ft) zone that is accessible to ecological receptors exceeded the ecological screening values. Two of the analogous waste sites with data had contamination in this zone above ecological screening values.
- Post-remediation, inadvertent intruder evaluations, indicate that constituents are still significantly above levels that might pose unacceptable risk based on an assumed inadvertent access anticipated at 2150 (that is approximately 150 years from today) at all of the representative waste sites and the analogous sites with data.

SUMMARY OF REMEDIAL ALTERNATIVES

As discussed in the feasibility study (DOE/RL-2003-64), remedial technologies were identified and evaluated on the basis of their ability to reduce potential risks to human health and the environment at the waste sites. Collective experience gained from previous studies and evaluations of cleanup methods at the Hanford Site were used to identify technologies that would be carried forward to develop remedial alternatives to address the RAOs. For the waste sites, five remedial alternatives were identified for detailed and comparative analyses.

These five alternatives also were evaluated for their applicability to the 241-B-361 and 241-T-361 Settling Tanks, the 216-BY-201 Settling Tank, and the 200-E-14 Siphon Tank. The volumes of sludge and/or liquid estimated to remain in each tank are as follows:

- 241-B-361: approximately 21,000 gallons of sludge and no liquid.
- 241-T-361: approximately 25,000 gallons of sludge and no liquid.
- 216-BY-201: The volume of sludge and liquid is uncertain. However, 750 gallons of sludge and 8,230 gallons of liquid may exist.
- 200-E-14: The volume of sludge and liquid is uncertain. However, 1,010 gallons of sludge and 11,060 gallons of liquid may exist.

Given the amount and nature of this material, removal of the sludge from these tanks is assumed for this Proposed Plan. However, confirmatory sampling results may indicate other options for the sludge, which will be evaluated following the confirmatory sampling activities.

The alternatives evaluated in the feasibility study include the following.

- **Alternative 1: No Action.** When this alternative is selected, no further action is taken at the site.

Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation. When this alternative is selected, existing soil covers (for example, the current soils that have been placed over the waste site to stabilize it, as well as the clean fill placed during construction of the waste site) are maintained as needed to continue to provide protection from intrusion by biological receptors (such as badgers) and humans. In addition, institutional controls (such as deed restrictions, land use zoning, and excavation permits) are put in place to further prevent human access to the site. Where appropriate, monitored natural attenuation is accounted for, because this is an ongoing process that reduces risk over time (such as the decay of radionuclides). Monitoring would be conducted to demonstrate that natural attenuation is occurring and that contamination is being contained as the concentrations decrease. This alternative is not evaluated if contaminants that pose a threat to groundwater from continued migration through the vadose zone are present in a waste site.

- **Alternative 3: Removal, Treatment, and Disposal.** When this alternative is selected, soil and structures with constituent concentrations above PRGs are excavated, using the observational approach. Because contamination levels at the majority of the waste sites pose a significant dose threat to workers, conventional techniques cannot be used for excavation activities. To excavate these waste sites, additional protections are required for the equipment and activities to protect the workers, the environment in the area, and the public that could be exposed near roads or facilities. These extra protections slow the excavation process and increase the cost. In addition, less-contaminated material is needed to blend with the more contaminated material to allow safe excavation, loading, transporting, and disposal of the material and to meet health and safety and waste acceptance criteria at the disposal facility. Excavated material that is above the PRGs will be disposed of at the Environmental Restoration Disposal Facility (ERDF) in accordance with that facility's established waste acceptance criteria. This disposal facility is reasonably close to the waste sites and has been used for remediation wastes on the Hanford Site. Any material that exceeds the disposal facility waste acceptance criteria would be stored onsite (consistent with storage requirements) until the material is treated to meet ERDF waste acceptance criteria, until a treatability variance is approved, or, in the case of waste with transuranic constituents at concentrations above levels of concern (i.e., 100 nCi/g), until the material can be shipped to an appropriate facility, such as the Waste Isolation Pilot Plant. The contaminated material is characterized and segregated during the excavation process and before being transported for disposal. Excavation would continue until all contaminated material exceeding the cleanup goal was removed. The site then would be backfilled with clean material.
- **Alternative 4: Capping.** When this alternative is selected, a surface barrier (such as a Hanford Barrier or an evapotransporation barrier) is built over the contaminated waste site, thus "capping" the site to prevent water from infiltrating into the waste and to prevent intrusion by human or ecological receptors. Institutional controls (such as deed restrictions, land use zoning, and excavation permits) are required to further minimize the potential for exposure

Institutional Controls
Nonengineered controls, such as administrative and/or legal controls, that minimize the potential for exposure to contamination by limiting land or resource use. The State of Washington also considers physical controls, such as fencing and signs, to be institutional controls.

Monitored Natural Attenuation
The monitoring of a decrease in concentration of a contaminant caused by natural processes such as radioactive decay, oxidation/reduction, biodegradation, and/or sorption.

Removal, Treatment, and Disposal
A cleanup method where soil and debris are excavated so that no contaminants remain at the site above the approved remediation goals for direct exposure and groundwater protection. Excavated material is treated (as necessary) and sent to either an onsite or an offsite engineered facility for disposal.

Observational Approach
A method of planning, designing, and implementing a remedial action that uses a limited amount of initial field sampling data to create a general understanding of the site conditions sufficient to proceed with cleanup. Information that is gathered during the remedial action phase is used to make real-time decisions to guide the remedial action. For some sites, this method is considered more cost- and time-effective than traditional methods that require large amounts of initial data to make detailed plans and designs for remedial actions.

ERDF
Environmental Restoration Disposal Facility. This is the Hanford Site's disposal facility for most waste and contaminated environmental media (dependant on the waste meeting the ERDF waste acceptance criteria) generated under a CERCLA response action. ERDF currently receives wastes from ongoing remedial and removal actions in the Hanford Site 100, 200, and 300 Areas.

Waste Acceptance Criteria
The criteria defined for the acceptance of waste for disposal at the engineered disposal facility; that is, the ERDF (see above).

The Nine CERCLA Criteria
Threshold Criteria:
- Overall protection of human health and the environment
- Compliance with ARARs

Balancing Criteria
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria
- State acceptance
- Community acceptance.

to contamination and to ensure the integrity of the cap. Performance monitoring is included as a part of this alternative to ensure that the cap is performing as expected, and groundwater monitoring is included to watch for movement of more mobile contaminants

- **Alternative 5: Partial Removal, Treatment, and Disposal with Capping.** When this alternative is selected, a portion of the subsurface soil associated with higher contaminant concentrations is removed, thereby reducing the industrial and/or intruder risk associated with the highly contaminated zone at the bottom of the waste site. This alternative is similar to Alternative 3, except that contaminants are not removed to the same depth as those in Alternative 3. Once the contamination has been removed, a cap similar to the cap described in Alternative 4 would be built in and over the excavation to provide protection to the groundwater from contaminants that remain deeper in the soil column. This alternative would reduce the risks to potential intruders past the assumed 150 years of institutional controls and would provide protection of the groundwater. Performance monitoring is included as a part of this alternative to ensure that the cap is performing as expected, and groundwater monitoring is included to watch for movement of more mobile contaminants.

CERCLA EVALUATION CRITERIA AND PROCESS

As a critical part of the evaluation process, the alternatives are evaluated against nine CERCLA criteria.

The first two criteria, overall protection of human health and the environment and compliance with ARARs, are **threshold criteria**. Alternatives that do not protect human health and the environment or that do not comply with ARARs (or justify a waiver) do not meet statutory requirements and are eliminated from further consideration in the feasibility study.

The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) are **balancing criteria** on which the remedy selection is based.

The final two criteria, state and community acceptance, are **modifying criteria**. In the case of this Proposed Plan, the state already concurs with the proposed alternatives outlined, and the plan identifies the preferred remedies that have already been accepted by the Tri-Parties. A preferred remedy's ability to meet the criterion of community acceptance, however, can be evaluated only after the public review and comment period for this Proposed Plan.

Under CERCLA, long-term effectiveness, short-term effectiveness, and implementability are three of the criteria that a preferred alternative must demonstrate. Specific to the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites, these three major criteria help distinguish between the removal, treatment, and disposal alternative, the capping alternative, and the partial removal, treatment, and disposal with capping alternative.

- For waste sites that have a potential to adversely impact groundwater because of contaminants at significant depth, there is a preference for selecting the capping alternative. At the representative waste sites within the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units, comparison to groundwater protection criteria and modeling indicate concentrations in excess of the groundwater protection criteria at locations ranging from near surface to the water table. The selection of an engineered barrier (capping) would minimize the exposure pathways between potential human and environmental receptors and the contaminants and also would limit infiltration. This means that the capping alternative would best meet the objective of no further degradation.

- For shallow, low-volume waste sites, there is a preference for the removal, treatment, and disposal alternative to reduce the exposure to and mobility of the contamination via long-term isolation in an onsite regulated disposal facility. In this case, removing the contaminants and placing them in a disposal facility eliminates the exposure pathways to potential human and environmental receptors. This alternative limits long-term stewardship of waste sites.
- For the removal, treatment, and disposal alternative and the partial removal, treatment, and disposal with capping alternative, the high concentrations and depths of contaminants deep in the vadose zone result in very high worker risk and cost associated with the excavation of contaminants. Also, the volumes of waste produced are very high, requiring significant expansion of existing disposal facilities or development of new disposal facilities. If sites with lower concentrations at more shallow depths are identified during the confirmatory sampling for the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit analogous waste sites, the cost effectiveness of the partial removal alternative can be reassessed. For these types of waste sites, there may be a preference for the partial removal, treatment, and disposal with capping alternative if the action results in acceptable worker risk, is more cost effective, and results in shorter maintenance and stewardship periods.

NEPA VALUES

DOE 1994, *Secretarial Policy on the National Environmental Policy Act* (NEPA), and DOE O 451.1A, *National Environmental Policy Act Compliance Program*, require that CERCLA documents incorporate NEPA values, such as analysis of cumulative, offsite, ecological, and socioeconomic impacts to the extent practicable, in lieu of preparing separate NEPA documentation for CERCLA activities. The NEPA process is intended to help Federal agencies:

- Make decisions that are based on understanding environmental consequences
- Take actions that protect, restore, and enhance the environment.

The NEPA-related resources and values that have been considered for these waste sites support the CERCLA and RCRA decision-making processes. For the remedies evaluated, NEPA impacts include temporary short-term disturbance (such as increased traffic, noise levels, and fugitive dust) of already disturbed industrial areas of low- to marginal-habitat quality. Appropriate capping material source areas were analyzed in DOE/EA-1403, *Environmental Assessment, Use of Existing Borrow Areas, Hanford Site, Richland, Washington*. Similar temporary impacts were identified. Long-term impacts identified for the remedies evaluated include negative aesthetic and visual impacts, should the caps not be adequately contoured to blend with the surrounding area. Minimal impacts are expected for air quality and natural, cultural, and historical resources. Overall, the long-term impacts to the public from these remedial actions would be positive (such as socioeconomic impacts related to employment opportunities).

NEPA values encompass a range of environmental concerns:

- Transportation impacts
- Air quality
- Natural, cultural, and historical resources
- Noise, visual, and aesthetic effects
- Socioeconomic impacts
- Environmental justice
- Cumulative impacts (direct and indirect)
- Mitigation
- Irreversible and irretrievable commitment of resources.

SUMMARY OF ALTERNATIVE EVALUATIONS AND PREFERRED ALTERNATIVES

The remedial alternatives developed in the feasibility study are evaluated for each representative site and its associated analogous waste sites). CERCLA typically requires evaluation of a "no action" alternative as a baseline for comparison to other alternatives.

Representative Site 216-B-46 Crib and Its Analogous Sites

Alternative 4, Capping, is the preferred alternative for representative site 216-B-46 Crib. The COCs include antimony, cadmium, cyanide, nitrate, uranium, cobalt-60, technetium-99, and radium-226.

The 216-B-46 Crib is the representative site for the following waste sites:

- The 216-B-43 through 216-B-45 Cribs and the 216-B-47 through 216-B-49 Cribs (located proximal to the 216-B-46 Crib and commonly referred to as the BY Cribs)
- The 216-B-14 through 216-B-19 Cribs (located in the BC Cribs and Trenches area south of the 200 East Area)
- The 216-B-20 through 216-B-22 Trenches (also located in the BC Cribs and Trenches area)
- The 216-B-42 Trench
- The 216-B-52 Trench (also located in the BC Cribs and Trenches area)
- The 216-B-51 French Drain
- The 216-BY-201 Settling Tank and 200-E-14 Siphon Tank
- The 200-E-114 Pipeline
- Unplanned Release UPR-200-E-9.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-1.

Based on current conditions, the 216-B-46 Crib exceeds the groundwater protection PRGs for antimony, cadmium, cyanide, nitrate, uranium, technetium-99, uranium-238, cobalt-60, and radium-226. The top of the contamination is about 5.5 m (18 ft) below ground surface; therefore, the 0 to 4.6 m (0 to 15-ft) zone is not associated with human health or ecological risk. The contaminants at the base of the crib (at 5.5 m [18 ft] below ground surface) do exceed PRGs associated with a potential intruder at 150 years.

The 216-B-46 Crib, along with the 216-B-43 through 216-B-45 Cribs and the 216-B-47 through 216-B-49 Cribs, are located in proximity to the BY Tank Farm. The 216-BY-201 Settling Tank also is located near this series of cribs. The 216-B-43 through 216-B-49 Cribs previously were investigated as part of the 200-BP-1 Operable Unit. The results of that investigation are reported in DOE/RL-92-70 and are summarized in the feasibility study (DOE/RL-2003-64). Risk assessment also was conducted for these sites and reported in the feasibility study. Similar to the 216-B-46 Crib, the contaminants associated with these cribs are located deeper than 4.6 m (15 ft) with the exception of the 216-B-47 Crib, which has contamination in this zone. Therefore, the human health and ecological risk PRGs are not exceeded at any of these cribs except for the 216-B-47 Crib. All these cribs have contamination in the vadose zone that exceeds groundwater protection PRGs. In addition, all these cribs have concentrations at 150 years that exceed the 15 mrem/yr standard for potential intruders. Characterization work was performed at the 216-B-26 Trench in 2003; the information from this characterization is included in the feasibility study, including risk assessment. The 216-B-26 Trench exceeds human health, ecological, groundwater protection, and intruder PRGs. The contaminant distributions for the BY Cribs (216-B-43, 216-B-44, 216-B-45, 216-B-47, 216-B-48, and 216-B-49), BC Cribs and Trenches (216-B-14 through 216-B-34, and 216-B-52), and 216-B-42 Trench are very similar to those of the 216-B-46 Crib. All of these sites pose a threat to groundwater and all present a significant risk to an intruder who would inadvertently be exposed to the contaminated soils at depth. Some will pose human health risks from direct exposure and ecological risk if their contamination is above 4.6 m (15 ft) below ground surface. Table B-4 summarizes the depth of clean fill for all the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites.

The contaminants are expected to be the same for the 216-BY-201 Settling Tank, 200-E-14 Siphon Tank, and 200-E-114 Pipeline; however, the contaminant distribution is expected to be much less for these sites when compared to the 216-B-46 Crib. The tanks were designed to hold effluents, not to discharge them to the ground. Existing information does not indicate leaks associated with the tanks. The pipeline, which is 4.8 km (3 mi) long, extends from the BY Tank Farm to the 216-B-14 through 216-B-19 Cribs. This pipeline is constructed of 5 cm (2-in.) diameter steel piping and was known to leaked in two small locations. The main risk associated with the settling and siphon tank is the sludge inside, which will be removed as part of the remedial alternative. Based on the conceptual site model, the groundwater protection PRGs are assumed to be met at the tanks and pipeline. Action at these sites would include the removal of the sludge from the tanks and partial removal of the 200-E-114 Pipeline from the BC Cribs area to Route 4 South. The removal of the pipeline would support the remedial action in the BC Cribs and Trenches area and would provide confirmatory sampling information for the rest of the pipeline.

The contamination at unplanned release UPR-200-E-9 and the 216-B-51 French Drain is expected to consist of the same contaminants as the 216-B-46 Crib but to be at much lower levels because only a fraction of the volume was released at these analogous sites. Groundwater protection PRGs are assumed to be met. Human health and ecological risk from direct exposure are assumed at these analogous sites. Contaminants are expected to meet PRGs at 150 years.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 3.

Overall Protection of Human Health and the Environment - The 216-B-46 Crib, along with the 216-B-14 through 216-B-19 Cribs, the 216-B-20 through 216-B-34 Trenches, the 216-B-43 through 216-B-45 Cribs, the 216-B-47 through 216-B-49 Cribs, the 216-B-52 Trench, the 216-BY-201 Settling Tank, and the 200-E-14 Siphon Tank obtain the most overall protection of human health and the environment through the implementation of Alternative 4, Capping, because:

- The exposure pathway is removed through the placement of the barrier
- Infiltration is reduced, which supports the protection of groundwater under RAO 2

Alternative 4, Capping, is the preferred alternative for analogous sites 216-B-43 through 216-B-45 and 216-B-47 through 216-B-49 Cribs, which are located in proximity to the 216-B-46 Crib representative site. The COCs are similar to the those of the 216-B-46 Crib and include cadmium, nitrate, nitrite, uranium, cesium-137, strontium-90, and technetium-99. Alternative 4, Capping, is also the preferred alternative for the 216-BY-201 Settling Tank. Sludge in the tank will be removed; the tank will be filled and capped with the BY Cribs.

Alternative 4, Capping, is the preferred alternative for analogous sites in the BC Cribs and Trenches Area south of the 200 East Area. These sites include 216-B-14 through 216-B-19 Cribs, the 216-B-20 through 216-B-34 Trenches, and the 216-B-52 Trench. The COCs are assumed to be similar to those of the representative site. Alternative 4, Capping, is also the preferred alternative for the 200-E-14 Siphon Tank. Sludge in the tank will be removed; the tank will be filled and capped with the BC Cribs.

Alternative 4, Capping, is the preferred alternative for analogous site 216-B-42 Trench. The COCs are assumed to be similar to those of the representative site.

TABLE 3. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-46 AND ITS ANALOGOUS SITES 216-B-14 THROUGH 216-B-34, 216-B-43 THROUGH 216-B-45, 216-B-47 THROUGH 216-B-49, 216-B-42, 216-B-52, 216-B-51, 216-BY-201, 200-E-14, 20-E-114, AND UPR-200-E-9

	ALTERNATIVES				
	❶ NO ACTION	❷ MESC, IC, MNA[a]	❸ RTD[b]	❹ CAPPING	❺ PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-46 Crib with Analogous Sites 216-B-43 through 216-B-45 Cribs and 216-B-47 through 216-B-49 Cribs (also known as the BY Cribs)				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$15	$399,703	$3,226	$19,618
Operating and maintenance costs	$0	$1,713	$0	$2,322	$2,175
Present worth	$0	$1,728	$399,703	$5,548	$21,793
Analogous Sites 216-B-14 through 216-B-19 Cribs, 216-B-20 through 216-B-34 Trenches, 216-B-42 Trench, 216-B-52 Trench, 216-BY-201 Settling Tank, 200-E-14 Siphon Tank, and Unplanned Release UPR-200-E-9				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$12,264	$3,249,276	$48,728	$298,840
Operating and maintenance costs	$0	$26,895	$0	$51,006	$33,126
Present worth	$0	$39,159	$3,249,276	$99,734	$331,966
Analogous Sites 216-B-51 French Drain and 200-E-114 Pipeline[d]		☑			
Threshold Criteria					
Overall Protection	☐	☑	☑	☑	NA
Compliance with Laws	☐	☑	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◈	◆	◆	NA
Short-term effectiveness	◈	◆	◇	◈	NA
Reduction in TMV[c]	◈	◈	◈	◈	NA
Implementability	◆	◆	◈	◆	NA
Cost (in thousands)					
Capital costs	$0	$15	$209,967	$3,195	NA
Operating and maintenance costs	$0	$2,101	$0	$3,946	NA
Present worth	$0	$2,116	$209,967	$6,141	NA

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. Toxicity, mobility, or volume through treatment
d. The portion of the 200-E-114 Pipeline from the BC Cribs (216-B-14 through 216-B-19) to Route 4 South will be removed to support BC Cribs and Trenches remedial actions and as confirmatory sampling to support the remedy proposed for the rest of the pipeline.

☑ (green) Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: substantially satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: minimally satisfies criterion

- Intrusion is reduced by the design of the barrier, which would include intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced. Under Alternatives 3 and 5, workers would be exposed to a dose of approximately 935 rem for excavation of the 216-B-43 through 216-B-49 Cribs. The capping alternative results in a lower dose associated only with removal of above ground structures, such as pipes.

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, limit human health, environmental, and groundwater impacts by removing contaminants and disposing of them in an on-site engineered facility. However, Alternatives 3 and 5 present unacceptable levels of worker risk associated with exposure to contaminants and deep excavation activities for sites with high contaminant concentrations and deep contamination. Alternatives 3 and 5 at these types of sites also result in large volumes of waste requiring disposal. Meeting PRGs under Alternative 3 would require removal of soil as deep as 67 m (220 ft). This type of excavation is difficult, requires workers to be exposed to the high contaminant concentrations as well as to risks associated with deep excavations, and has the potential to impact neighboring facilities, such as the tank farms. This type of excavation is expensive and creates considerable waste that requires disposal. Alternative 5 would require removal of the most highly contaminated zones beneath the waste sites, to depths of 7.6 m (25 ft) or more.

The 200-E-114 Pipeline, however, obtains the most overall protection of human health and the environment through the implementation of Alternative 3, because contaminants are removed, treated as appropriate, and disposed of at the on-site engineered facility. Alternative 2 is protective as well, because contamination is expected to be minimal with this waste site, which consists of a 2-inch-diameter steel pipeline, and the existing 2 to 3 m (7- to 10-ft) soil cover and institutional controls would prevent exposure while contaminants decay to PRG levels, assumed to be within 150 years.

Alternative 1 is not protective of any of the waste sites, because constituents remain above the PRGs. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs. Alternative 2 does not comply with ARARs for any of the waste sites except the 200-E-114 Pipeline, where groundwater protection PRGs are not expected to be exceeded and direct exposure and environmental PRGs are expected to be attained within the 150-year institutional controls period. ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of all contaminated material. Alternative 5 meets the ARARs through the removal of the high concentrations of contaminants at the bottom of the waste sites and the placement of an engineered barrier to address remaining contaminants. Alternative 4 meets the ARARs using an engineered barrier, which eliminates the exposure pathway and limits infiltration to protect groundwater.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 do not provide long-term effectiveness or permanence because contaminants are not remediated and will remain following industrial land use through 2150. The 200-E-114 Pipeline is an exception. For the pipeline, Alternative 2 provides

Alternative 2, Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for analogous site 200-E-114 pipeline. However, a portion of the pipeline will be removed. If contamination at potential leaks sites is identified during confirmatory sampling, these areas also may be removed. The COCs are assumed to be the same as the representative site.

Alternative 2, Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for analogous site 216-B-51 French Drain. The COCs are assumed to be the same as the representative site but at much lower levels, because only a small volume was discharged to this site.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for analogous site UPR-200-E-9. The COCs are assumed to be similar to the representative site.

long-term effectiveness and permanence, because the contaminants are expected to decay within 150 years. The existing soil cover and institutional controls limit exposures while the contaminants naturally decay to PRG levels. Groundwater protection PRGs are assumed to be met at the pipeline. A portion of the pipeline near the BC Cribs will be removed, which will provide additional information to confirm the conceptual model at this waste site. Alternative 3 provides the most long-term effectiveness and permanence, because contaminants above PRGs are removed from the site and disposed of at a suitable facility. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier while the residual risk of contaminants will decrease to acceptable levels through natural radioactive decay. Alternative 4 reduces infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap augment the effectiveness of Alternative 4. For sites where transuranic constituents are at concentrations above levels of concern, the cap design would need to reflect the longevity of these contaminants. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to show no further degradation based on the elevated concentrations of contaminants that pose a threat to the groundwater (for example, technetium-99 and uranium). Alternative 5 provides long-term effectiveness and permanence by removing the mass of higher concentration contaminants and capping the remaining contaminants to protect groundwater.

Short-term Effectiveness - Alternative 1 would be effective for workers in the short term, because this alternative does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) zone, human and ecological receptors may not be protected. Historical evidence indicates that the ecological receptors have played a role in dispersing contaminants from waste sites in the BC Cribs and Trenches area. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5, predominantly because of their lower risk to remediation workers. Alternatives 3 and 5 involve excavating contaminated soil and debris, resulting in significant short-term worker impacts during excavation, loading, transportation, and disposal of the materials because of the high concentrations associated with most of these waste sites. Risks to workers from potential exposure to contaminated soil and fugitive dust would be similar for Alternatives 3 and 5, in that both subject the workers to the highly contaminated areas at the bottom of the waste sites. Alternative 3 would present the greatest short-term risk to workers associated with both the contamination and the excavation activities as deep as 86.9 m (285 ft). Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2 because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites used to obtain capping materials would be disturbed. The waste sites have either limited habitat associated with highly disturbed gravel surfaces, or monoculture habitats of planted wheatgrass. These latter habitats have shown some real diversity in recent studies on similar sites, such as the Gable Mountain Pond. The short-term impacts to vegetation and wildlife could be potentially high for Alternatives 3 and 5 because of the large volumes of borrow material needed to backfill the excavations and the timeframes needed to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the top of the contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternative 3, but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except for natural attenuation. All of the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived reduction because these alternatives include a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are either posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site, and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is considered very complicated to implement because of high contamination and the depths of excavation that would be required. The high contamination levels in the soil at the bottom of some waste sites would result in dose levels as high as 935 rem[2] to workers and would require special techniques and protections to reduce these levels to an acceptable range. Alternative 3 would require significant downblending of removed soil with less contaminated soil to meet health and safety requirements and to meet waste acceptance criteria. This requires a large volume of material to backfill and generates 5 to 10 times as much waste. Approximately 5.7 m^3 (7.4 million yd^3) of waste would be generated to meet the PRGs. This exceeds the current capacity of ERDF. In addition, excavation to depths required to meet PRGs would result in interferences with the existing cap on the 216-B-57 Crib, underground piping, and utilities. Excavation is not practicable or cost effective at these depths, especially in light of the contamination levels. The excavation component of Alternative 5 is similar to Alternative 3 and is considered very difficult and hazardous to implement.

Cost - Capital costs and operating and maintenance costs are provided in Table 3. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 3 associated with Alternative 3 for the 216-B-46 Crib include full excavation of the contaminated material. The costs associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs associated with Alternative 5 include excavation

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[2] Based on removal and disposal of contamination at the 216-B-43 through 216-B-49 Cribs to meet PRGs. Other analogous waste sites are assumed to have high dose rates similar to the representative site 216-B-46 Crib, included in this dose estimate.

of contaminated soils to a depth of 7.6 m (25 ft) or more, followed by an engineered barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for 216-B-46 Crib, the 216-B-14 through 216-B-19 Cribs, the 216-B-20 through 216-B-34 Trenches, 216-B-43 through 216-B-45 Cribs, the 216-B-47 through 216-B-49 Cribs, and the 216-B-52 Trench is Alternative 4, Capping. This alternative is the most protective of human health, the environment, the groundwater, and workers.
- The preferred alternative for the 216-BY-201 Settling Tank is Alternative 4, Capping, because of its proximity to the BY Cribs (216-B-43 through 216-B-49). The preferred alternative for the 200-E-14 Siphon Tank is also Alternative 4, Capping, because of its proximity to the BC Cribs (216-B-14 through 216-B-19 Cribs). Sludge removal is assumed for both tanks.
- The preferred alternative for the 200-E-114 Pipeline and the 216-B-51 French Drain is Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, because this alternative provides protectiveness for the minor contamination assumed for this waste site. A portion of the pipeline from the BC Cribs to Route 4 South will, however, be removed through Alternative 3, Removal, Treatment, and Disposal, to facilitate remedial actions in the BC Cribs and Trenches area and to provide additional data to support the conceptual model for this waste site.
- The preferred alternative for UPR-200-E-9 is Alternative 3, Removal, Treatment, and Disposal, because this alternative is most protective of human health and the environment at these waste sites and is easily implementable with acceptable worker risk.

The agencies believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost effective.

Representative Site 216-T-26 Crib and Its Analogous Waste Site

Alternative 4, Capping, is the preferred alternative for representative site 216-T-26 Crib. The COCs include cyanide, nitrate, nitrite, uranium, technetium-99, and plutonium-239.

Alternative 4, Capping, is the preferred alternative for analogous site 216-T-18 Crib. The COCs are assumed to be generally similar to the representative site; however, the 216-T-18 Crib received 1,800 g of plutonium, much more than the 216-T-26 Crib.

The 216-T-26 Crib is the representative site for the 216-T-18 Crib. The conceptual site model for these sites is presented in Table 1, with further information provided in Appendix B, Table B-1.

Based on current conditions, the 216-T-26 Crib exceeds the groundwater protection PRGs for cyanide, nitrate, nitrite, uranium, technetium-99, uranium-233/234/238, and plutonium-239. Elevated concentrations are found throughout the soil column to nearly 60 m (200 ft) below ground surface.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 4.

Overall Protection of Human Health and the Environment - The 216-T-26 and 216-T-18 Cribs obtain the most overall protection of human health and the environment through the implementation of Alternative 4, Capping, because:

- The exposure pathway is removed through the placement of the barrier
- Infiltration is reduced, which supports the protection of groundwater under RAO 2

TABLE 4. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-T-26 AND ANALOGOUS SITE 216-T-18

	ALTERNATIVES				
	❶ NO ACTION	❷ MESC, IC, MNA[a]	❸ RTD[b]	❹ CAPPING	❺ PARTIAL REMOVAL/ CAPPING
Representative Site 216-T-26 Crib				✅	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$15	$39,576	$639	$1,395
Operating and maintenance costs	$0	$671	$0	$487	$675
Present worth	$0	$686	$39,576	$1,126	$2,070
Analogous Site 216-T-18				✅	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$15	$39.576	$689	$1,395
Operating and maintenance costs	$0	$671	$0	$487	$675
Present worth	$0	$686	$39,576	$1,126	$2,070

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. Toxicity, mobility, or volume through treatment

✅ Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: best satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: least satisfies criterion

- Intrusion is reduced by the design of the barrier, which would include intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced, because the workers would not be exposed to deep excavations. The worker dose is approximately 0.54 rem associated with the excavation alternatives (Alternatives 3 and 5).

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, limit human health and environmental impacts by removing contaminants and disposing of them in an onsite engineered facility. Alternative 5 provides for protection of remaining contaminants after excavation by use of an engineered barrier. Both alternatives result in significant risk to workers because of the high concentrations of contaminants.

Alternatives 1 and 2 are not protective, as constituents remain above the PRGs. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternatives 1 and 2 do not comply with ARARs, because the waste sites currently exceed the RAOs. Alternatives 3, 4, and 5 meet ARARs for both waste sites. Alternative 3 meets ARARs through the removal of the contaminated material to meet PRGs. Alternative 4 meets the ARARs by using an engineered barrier that eliminates the exposure pathway to humans and ecological receptors and limits infiltration, thereby providing groundwater protection. Alternative 5 meets ARARs by removing a portion of the contamination to meet PRGs associated with risks to humans and ecological receptors from direct exposure and intrusion and by capping remaining contaminants to meet ARARs associated with groundwater protection.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain following industrial land use through 2150.

Alternative 3 is the most reliable and permanent for the 216-T-26 and 216-T-18 Cribs, because contaminants will be removed above the PRGs, based on the conceptual site model. Alternative 4 provides reliability by reducing exposure using an engineered barrier and incorporating intrusion barriers to limit access by the receptors during the time necessary for the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay (330 years). Groundwater monitoring will be required to show no further degradation based on the elevated concentrations of contaminants that could impact groundwater.

Short-term Effectiveness - Alternative 1 would be effective for worker protection in the short term, because this alternative does not involve any remedial actions. Because contaminants are located deeper than 4.6 m (15 ft), short-term risks to the environment are not expected at these sites. Alternatives 2 and 4 would be more effective in the short term than Alternative 3, predominantly because of their lower risk to remediation workers. Alternative 3 will involve excavating contaminated soil and debris, which would create a potential for short-term worker impacts during excavation and transportation of the materials. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, minimal to moderate for Alternative 4 because of impacts to borrow areas, and moderate to high for Alternatives 3 and 5 because of impacts to borrow areas and the large areas that would be disturbed to reach the required excavation depths. These two sites are currently covered by gravel.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included in Alternatives 3 and 5 but is not anticipated because the constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional perceived reduction because this alternative includes a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater. The 216-T-18 Crib has been identified as having received a volume of plutonium sufficient to exceed a concentration of 100 nCi/g. Confirmatory sampling will likely be required to test the validity of this assumption. If these concentrations are present at this crib, disposal options would change from ERDF to the Waste Isolation Pilot Project under Alternatives 3 and 5. Treatment would be conducted as required to meet waste disposal criteria. Based on existing information from the 216-B-7A Crib, which received significantly more plutonium that the 216-T-18 Crib (4,300 grams for 216-B-7A Crib as opposed to 1,800 grams for 216-T-18 Crib), these concentrations of plutonium and other transuranic constituents are not anticipated (see DOE/RL-2002-42 for details on the 216-B-7A Crib sampling).

Implementability - Alternative 1 would be easily implemented, because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered very complicated to implement because of the depths (61 m [200 ft]) of excavation that would be required. Alternative 3 would require significant downblending of removed soil with less contaminated soil to meet health and safety requirements and to meet waste acceptance criteria. This requires a large volume of material to backfill and generates 5 to 10 times as much waste as a normal excavation. Approximately 9,280 m^3 (12,000 yd^3) of waste would be generated to meet the PRGs In addition, excavation to depths required to meet PRGs would result in interferences with neighboring facilities, such as other waste sites (216-T-27 and 216-T-28 Cribs). Excavation is not practicable or cost effective at these depths, especially in light of the contamination levels. The excavation component of Alternative 5 is similar to Alternative 3 and is considered very difficult and hazardous to implement. Alternative 4 is easily implemented. A barrier has been implemented at the Hanford Site, and other types of barriers have been regulatory approved and implemented at other western arid sites and are easy to construction and maintain.

Cost - Capital costs and operating and maintenance costs are provided in Table 4. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 4 that are associated with Alternative 3 for the 216-T-26 Crib include full excavation of the contaminated material to meet PRGs. The costs in Table 4 that are associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs in Table 4 that are associated with Alternative 5 include excavation of contaminated soils to a depth of 12.2 m (40 ft) followed by construction of an engineered barrier to protect remaining contaminants in the deeper vadose zone.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-T-26 and 216-T-18 Cribs is Alternative 4, Capping. This alternative is protective of the groundwater, is protective of the workers, is easily implementable, and is cost effective

The agencies believe that the preferred alternative is protective of human health and the environment, complies with ARARs, uses permanent solutions, and is cost effective.

Representative Waste Site 216-B-5 Injection/Reverse Well and Its Analogous Waste Site

Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for representative site 216-B-5 Injection/Reverse Well. The COCs include cesium-137, strontium-90, americium-241, and plutonium-239/240.

Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for analogous waste site 216-T-3 Injection/Reverse Well. The COCs are assumed to be similar to those of the representative site.

The 216-B-5 Injection/Reverse Well is the representative site for the 216-T-3 Injection/Reverse Well. The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-2.

Contaminants disposed of to the 216-B-5 Injection/Reverse Well were injected near the water table from 75 to 86.6 m (243 to 284 ft) below ground surface. Contaminants identifed in the vadose zone above the water table and in the groundwater include strontium-90, cesium-137, americium-241, and plutonium-239/240. Because the contaminants are located deep in the vadose zone, direct exposure risk to human and ecological receptors at the surface is not a concern. Protection of groundwater is the main concern; however, the contamination is already in the groundwater. Current data indicate that the contaminants in the vadose are not continuing to impact the groundwater. For example, the concentrations in the groundwater are generally decreasing. Geophysical logging results of wells in the vicinity of the 216-B-5 Injection/Reverse Well do not indicate that contaminants are moving to the water table. The contaminants associated with the reverse well generally are not mobile in the environment. Two of the main contaminants, strontium-90 and cesium-137, have relatively short half-lives, and concentrations will reduce significantly through time. Other technologies for addressing deep contamination include deep soil mixing, grout injection, and soil flushing. Each of these technologies was evaluated in the feasibility study. They were subsequently screened out based on effectiveness, implementability, and cost.

The 216-T-3 Injection/Reverse Well is expected to have a contaminant distribution similar to the that of 216-B-5 Reverse Well, but with contaminants located higher in the vadose zone. The waste was discharged at the 216-T-3 Reverse Well between 32 and 62.2 m (105 and 204 ft) below ground surface, approximately 5.5 m (18 ft) above the water table.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 5.

Overall Protection of Human Health and the Environment - The 216-B-5 and 216-T-3 Injection/Reverse Wells obtain the most overall protection of human health and the environment through the implementation of Alternative 3, Removal,

TABLE 5. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-5 AND ANALOGOUS SITE 216-T-3

	ALTERNATIVES				
	1 NO ACTION	2 MESC, IC, MNA[a]	3 RTD[b]	4 CAPPING	5 PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-5 Injection/Reverse Well		☑			
Threshold Criteria					
Overall Protection	☐	☑	☑	☑	NA
Compliance with Laws	☐	☑[c]	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◈	◆	◇	NA
Short-term effectiveness	◈	◆	◇	◈	NA
Reduction in TMV[d]	◈	◈	◈	◈	NA
Implementability	◆	◆	◇	◈	NA
Cost (in thousands)[e]					
Capital costs	$0	$237	$102,830	$1,048	$0
Operating and maintenance costs	$0	$677	$0	$579	$0
Present worth	$0	$914	$102,830	$1,627	$0
Analogous Site 216-T-3 Injection/Reverse Well		☑			
Threshold Criteria					
Overall Protection	☐	☑	☑	☑	NA
Compliance with Laws	☐	☑[c]	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◈	◆	◇	NA
Short-term effectiveness	◈	◆	◇	◈	NA
Reduction in TMV[d]	◈	◈	◈	◈	NA
Implementability	◆	◆	◇	◈	NA
Cost (in thousands)[e]					
Capital costs	$0	$237	$49,552	$1,048	$0
Operating and maintenance costs	$0	$677	$0	$579	$0
Present worth	$0	$914	$49,552	$1,627	$0

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. ARAR waiver required
d. Toxicity, mobility, or volume through treatment
e. Includes decommissioning of reverse well except for no action.

☑ (green) Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: substantially satisfies criterion
◈ Moderate: partially satisfies criterion
◇ Low: minimally satisfies criterion

Treatment, and Disposal, because soils contaminated above PRGs would be removed. Contaminants in the groundwater would not be addressed by this action, but will be addressed by the 200-BP-5 Groundwater Operable Unit

Alternative 1 is not protective, because constituents remain above the PRGs and no monitoring would be performed to track contaminant movement or attenuation. Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation provides overall protectiveness to the reverse wells by limiting exposure through institutional controls and by monitoring contaminant movement. Alternative 2 includes the decommissioning of the reverse wells to WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells." Other wells in the area that are not needed to support monitoring also would be decommissioned, to eliminate pathways for infiltration through the contaminated vadose zone. Alternative 4 is not protective because the contaminants are already at the water table. Alternative 3 is protective of further degradation of the groundwater by removal of the contaminants in the vadose zone to meet PRGs. Alternative 5 is not applicable to these waste sites, because the contamination is only found deep in the vadose zone.

Compliance with ARARs - Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs. Alternative 2 does not comply with ARARs for the groundwater; therefore, an ARAR waiver would be required. Treatability testing in the 1990s at the 216-B-5 Injection/Reverse Well showed that pump-and-treat technologies were not effective for the contaminants in the groundwater. With the ARAR waiver, Alternative 2 meets the ARARs through the implementation of institutional controls and monitoring. Similarly, Alternatives 3 and 4 would also require ARAR waivers for the groundwater. Alternative 5 is not applicable to these waste sites.

Long-term Effectiveness and Permanence - Alternative 1 does not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain at the waste sites without monitoring or institutional controls. For the 216-B-5 and 216-T-3 Injection/Reverse Wells, Alternative 2 provides long-term effectiveness and permanence associated with the institutional controls and monitoring. Alternative 3 is the most effective and permanent for protecting the groundwater from the remaining contaminants in the soil column, because the contamination would be removed to meet PRGs; however, this alternative is not considered practicable for contaminants at these depths. Alternative 4 would not provide significant effectiveness or permanence because the contaminants are already at the water table. Alternative 5 is not applicable to these waste sites.

Short-term Effectiveness - Alternative 1 would be effective in the short term, because this alternative does not involve any remedial actions, and the groundwater is not currently used. Alternatives 2 and 4 would be more effective in the short term than Alternative 3, because of their lower risk to remediation workers. Alternative 3 involves excavating contaminated soil and debris, creating a potential for short-term worker impacts during excavation and transportation of the materials. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1, 2, and 4, because the contamination is well below the access depth for these receptors. Alternative 3 could significantly impact vegetation and wildlife associated with a large excavation area, a large staging area, and borrow areas for backfill.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is an element of Alternative 3 but is not anticipated, because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional perceived reduction, because this alternative includes a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered very complicated to implement because of the depths of excavation that would be required. Worker hazards are increased as the depth of excavation increases. To reach 67 m (220 ft) below ground surface, an area of approximately 71,160 m² (765,630 ft²) would be disturbed. Excavation is not practicable or cost effective at these depths. Alternative 4 is easily implemented, but not effective. Alternative 5 is not applicable to these waste sites.

Cost - Capital costs and operating and maintenance costs are provided in Table 5. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 5 that are associated with Alternative 3 for the 216-B-5 Injection/Reverse Well include full excavation of the contaminated material in the vadose zone. The costs in Table 5 that are associated with Alternative 4 are for an engineered barrier that provides infiltration protection.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-5 and 216-T-3 Injection/Reverse Wells is Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation. This alternative is the most implementable for the deep contamination found at these sites and provides protection through groundwater monitoring.

The agencies believe that the preferred alternative is protective of human health and the environment, complies with ARARs through the use of an ARAR waiver, and is cost effective.

Representative Site 216-B-7A Crib and Its Analogous Waste Sites

Alternative 4, Capping, is the preferred alternative for representative site 216-B-7A Crib. The COCs include cyanide, fluoride, nitrate, cesium-137, strontium-90, and plutonium-239/240.

The 216-B-7A Crib is the representative site for the following waste sites:

- The 216-B-7B, 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs
- The 216-T-5 Trench
- The 200-E-45 Sampling Shaft
- The 241-B-361 and 241-T-361 Settling Tanks
- Unplanned Release UPR-200-E-7.

Alternative 4, Capping, is the preferred alternative for analogous waste sites 216-B-7B Crib, 216-B-8 Crib, 216-B-6 Crib, 216-B-9 Crib, 216-T-5 Trench, 216-T-7 Crib, 216-T-32 Crib, and 200-E-45 Sampling Shaft. The COCs are assumed to be similar to the representative site, only some may not have transuranic constituents exceeding 100 nCi/g.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for analogous waste site UPR-200-E-7. The COCs are assumed to be similar to the representative site.

Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for analogous waste sites 241-B-361 Settling Tank and 241-T-361 Settling Tank. Sludge removal is assumed for the tanks. The COCs are assumed to be similar to the representative site; however, risks are assumed to be associated with the sludge.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-2.

Based on current conditions, the 216-B-7A Crib exceeds the groundwater protection PRGs for cyanide, fluoride, nitrate, technetium-99, uranium, and strontium-90. The top of the contamination is about 5.5 m (18 ft) below ground surface; therefore, the 0 to 4.6 m (0 to 15-ft) zone is not associated with human health or ecological risk. The contaminants at the base of the crib (at 18 ft below ground surface) would exceed PRGs associated with a potential intruder at 150 years. The 216-B-7A Crib, along with the 216-B-7B Crib, is located in close proximity to and just north of the 241-B Tank Farm. The 216-B-8 Crib and the 200-E-45 Sampling Shaft are located to the north of the 216-B-7A Crib. The 216-T-6 Crib is located next to the 241-B-361 Settling Tank. The 216-B-9 Crib is located north of the 216-B-5 Injection/Reverse Well. The 216-T-5 Trench and the 216-T-7 and 216-T-32 Cribs are located to the west of the T Tank Farm. Remedial investigation activities and results for the 216-B-7A Crib are reported in DOE/RL-2002-42. The crib had concentrations of plutonium-239/240 at 5.8 m (19 ft) below ground surface of 153,000 pCi/g. Two of the waste sites analogous to the 216-B-7A Crib may have elevated levels of plutonium and/or other transuranic constituents. This material was disposed of before 1970. The 216-B-7B, 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs and the 216-T-5 Trench are assumed to have contamination in the vadose zone that exceeds groundwater protection PRGs. In addition, these waste sites are assumed to have concentrations at 150 years that exceed the 15 mrem/year standard for potential intruders. Some will also pose human health risks from direct exposure and ecological risk if their contamination is above 4.6 m (15 ft) below ground surface. Table B-4 summarizes the depth of clean fill for all the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites. The 200-E-45 Sampling Shaft is associated with the 216-B-8 Crib. The shaft was used to sample the contamination levels in the 216-B-8 Crib and later, to test contaminated pumps. Contaminants are expected to be similar to those for the 216-B-7A Crib, but may not necessarily pose a risk to groundwater. The shaft is located next to the 216-B-8 Crib and will be addressed as part of the crib.

The contaminants are expected to be the same for the 241-B-361 and 241-T-361 Settling Tanks; however, the contaminant distribution is expected to be much less for these sites when compared to the 216-B-7A Crib. The tanks were designed to hold effluents, not to discharge them to the ground. Existing information does not indicate leaks associated with the tanks. The main risk associated with the settling tanks is the sludge inside, which will be removed as part of the remedial alternative. Based on the conceptual site model, the groundwater protection PRGs are assumed to be met at the settling tanks. As previously discussed, 174,129 liters (46,000 gallons) of sludge remain within the settling tanks.

The contamination at unplanned release UPR-200-E-7 is expected to consist of the same contaminants as at the 216-B-7A Crib, but much lower levels are expected because only a fraction of the volume was released at the unplanned release site. Groundwater protection PRGs are assumed to be met. Human health and ecological risk from direct exposure are assumed at this site. Contaminants are expected to meet PRGs within 150 years at the unplanned release.

Alternative Evaluations

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 6.

TABLE 6. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-7A AND ANALOGOUS SITES 216-B-7B, 216-B-8, 216-B-9, 241-B-361, 200-E-45, 216-T-5, 216-T-6, 216-T-7, 216-T-32, 241-T-361, AND UPR-200-E-7

	ALTERNATIVES				
	❶ NO ACTION	❷ MESC, IC, MNA[a]	❸ RTD[b]	❹ CAPPING	❺ PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-7A and 216-B-7B Cribs				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$15	$244,003	$1,412	$1,386
Operating and maintenance costs	$0	$668	$0	$756	$282
Present worth	$0	$683	$244,003	$2,168	$1,917
Analogous Sites 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs; 216-T-5 Trench; and 200-E-45 Sampling Shaft				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$219	$1,684,815	$13,317	$59,279
Operating and maintenance costs	$0	$11,349	$0	$13,601	$5,998
Present worth	$0	$11,568	$1,684,815	$26,918	$65,277
Analogous Site UPR-200-E-7			☑		
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	NA
Compliance with Laws	☐	☐	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	NA
Short-term effectiveness	◈	◈	◈	◈	NA
Reduction in TMV[c]	◈	◈	◈	◈	NA
Implementability	◆	◆	◆	◆	NA
Cost (in thousands)					
Capital costs	$0	$0[e]	$265	$14	NA
Operating and maintenance costs	$0	$412	$0	$650	NA
Present worth	$0	$412	$265	$664	NA
Analogous Sites 241-B-361 and 241-T-361 Settling Tanks[d]		☑			
Threshold Criteria					
Overall Protection	☐	☑	☑	☑	NA
Compliance with Laws	☐	☑	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◈	◆	◆	◆	NA
Short-term effectiveness	◆	◈	◈	◈	NA
Reduction in TMV[c]	◈	◈	◈	◈	NA
Implementability	◆	◆	◇	◆	NA
Cost (in thousands)					NA
Capital costs	$0	$12,031	$14,156	$14,617	NA
Operating and maintenance costs	$0	$1,000	$0	$1,369	NA
Present worth	$0	$13,362	$14,156	$15,986	

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Remove, treat, dispose
c. Toxicity, mobility, or volume through treatment
d. Includes removal of sludge except under no action
e. Capital cost less than $1,000

☑ Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: best satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: least satisfies criterion

Overall Protection of Human Health and the Environment - The 216-B-7A Crib, along with the 216-B-7B, 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs; the 216-T-5 Trench; and the 200-E-45 Sampling Shaft obtain the most overall protection of human health and the environment through the implementation of Alternative 4, Capping, because:

- The exposure pathway is removed through the placement of the barrier
- Infiltration is reduced, which supports the protection of groundwater under RAO 2
- Intrusion is reduced by the design of the barrier, which would include intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced, because the workers would not be exposed to the high doses. The approximate worker dose associated with the excavation alternatives is 6 rem.

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, limit human health, environmental, and groundwater impacts by removing contaminants and disposing of them in an on-site engineered facility. However, Alternatives 3 and 5 present unacceptable levels of worker risk associated with exposure to contaminants and deep excavation activities for sites with high contaminant concentrations and deep contamination. Alternatives 3 and 5 at these types of sites also results in large volumes of waste requiring disposal. To remove all contaminants above PRGs under Alternative 3 would require removal as deep as 67.7 m (222 ft). This type of excavation is difficult, requires workers to be exposed to the high contaminant concentrations as well as the risks associated with deep excavations, and would impact neighboring facilities such as the B Tank Farm. This type of excavation is expensive and creates considerable waste that requires disposal. Alternative 5 would require removal of the most highly contaminated zones beneath the waste sites, as deep as 8.5 m (28 ft).

Unplanned release UPR-200-E-7 obtains the most overall protection of human health and the environment through the implementation of Alternative 3. Contaminants are removed, treated as appropriate, and disposed of at the on-site engineered facility.

Alternative 2 generally is not protective, because contaminants at the cribs, the trench, and the sampling shaft pose a threat to groundwater and to potential intruders that Alternative 2 would not address. However, for sites with less contamination, such as the 241-B-361 and 241-T-261 Settling Tanks, Alternative 2 would be protective because the sludge would be removed from the tanks and remaining contaminants are expected to reach PRGs within 150 years. Alternative 2 is not considered protective at UPR-200-E-7 because contaminants are located near the surface, potentially posing an ecological and/or human health risk.

Alternative 1 is not protective of any of the waste sites, because constituents remain above the PRGs. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs. Alternative 2 does not comply with ARARs for any of the waste sites except the 241-B-361 and 241-T-361 Settling Tanks, where groundwater protection PRGs are not expected to be exceeded and direct exposure and environmental PRGs are expected to be attained within the 150-year institutional controls period. ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of all contaminated material. Alternative 5 meets the ARARs through the removal of the high concentrations of contaminants at the bottom of the waste sites and the placement of an engineered barrier to address remaining contaminants. Alternative 4 meets the ARARs using an engineered barrier, which eliminates the exposure pathway and limits infiltration to protect groundwater.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain after the 150-year institutional controls period, assumed through 2150, with the exception of the 241-B-361 and 241-T-361 Settling Tanks. The existing soil cover and institutional controls limit exposures while the contaminants naturally decay to PRG levels. Groundwater protection PRGs are assumed to be met at the pipeline. Alternative 3 provides the most long-term effectiveness and permanence because contaminants above PRGs are removed from the site and disposed of at a suitable facility. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier. During that time, the residual risk of contaminants will decrease to acceptable levels through natural radioactive decay. Alternative 4 reduces infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap augment the effectiveness of Alternative 4. For sites where transuranic constituents are at concentrations above levels of concern, the cap design would need to reflect the longevity of these contaminants. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to show no further degradation based on the elevated chemical and radionuclide concentrations that pose a threat to groundwater. Alternative 5 provides long-term effectiveness and permanence by removing the mass of higher concentration contaminants and capping the remaining contaminants to protect groundwater.

Short-term Effectiveness - Alternative 1 would be effective for workers in the short term, because this alternative does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) zone, human and ecological receptors may not be protected. Historical evidence indicates that the ecological receptors have played a role in dispersing contaminants from waste sites in the BC Cribs and Trenches area. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5. Alternatives 2 and 4 have much lower risk to remediation workers than Alternatives 3 and 5. Alternatives 3 and 5 involve excavating contaminated soil and debris, which would result in significant short-term worker impacts during excavation, loading, transportation, and disposal of the materials because of the high concentrations associated with most of these waste sites. Risks to workers from potential exposure to contaminated soil and fugitive dust would be similar for Alternatives 3 and 5, because both subject the workers to the highly contaminated areas at the bottom of the waste sites. Alternative 3 would present the greatest short-term risk to workers associated with both the contamination and the excavation activities to depths up to 67.7 m (222 ft). Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites used to obtain capping materials would be disturbed. The waste sites have either limited habitat associated with highly disturbed gravel surfaces or monoculture habitats of planted wheatgrass. These latter habitats have shown some real diversity in recent studies on similar sites, such as the Gable Mountain Pond. The short-term impacts to vegetation and wildlife could be potentially high for Alternatives 3 and 5 because of the large volumes of borrow material needed to backfill the excavations and the timeframes needed to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the top of the contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternatives 3 and 5 but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except by natural attenuation. An exception would be transuranic constituents at levels exceeding 100 nanocuries per gram, which might require treatment to meet waste acceptance criteria if excavated. All of the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived reduction, because they include a physical action that places the contaminants in a more managed environment, which conceivably reduces the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site, and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is considered very complicated to implement because of high contamination and the depths of excavation that would be required. The potential presence of transuranic constituents at some of the sites increases the risk to workers because of airborne contaminant concerns. The high contamination levels in the soil at the bottom of some waste sites would result in dose levels as high as 6 rem to workers and would require special techniques and protections to reduce these levels to an acceptable range. Alternative 3 would require significant downblending of removed soil with less-contaminated soil to meet health and safety requirements and to meet waste acceptance criteria. This alternative requires a large volume of material to backfill the excavation and generates 5 to 10 times as much waste as a normal excavation. Approximately

63,710 m^3 (83,280 yd^3) of waste would be disposed of at ERDF. In addition, excavation to depths required to meet PRGs would result in interferences with neighboring facilities, such as the B Tank Farms, underground piping, buildings, and utilities. Excavation is not practicable or cost effective at these depths, especially in light of the contamination levels. The excavation component of Alternative 5 is similar to that of Alternative 3 and is considered very difficult and hazardous to implement.

Cost - Capital costs and operating and maintenance costs are provided in Table 6. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 6 that are associated with Alternative 3 for the 216-B-7A Crib include full excavation of the contaminated material to meet PRGs. The costs in Table 6 that are associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs in Table 6 that are associated with Alternative 5 include excavation of contaminated soils to a depth of 8.5 m (28 ft), followed by construction of an engineered barrier designed to limit infiltration.

PREFERRED ALTERNATIVES

- The preferred alternative for 216-B-7A, 216-B-7B, 216-B-8, 216-B-9, 216-T-6, 216-T-7, and 216-T-32 Cribs; the 216-T-5 Trench, and the 200-E-45 Sampling Shaft is Alternative 4, Capping. This alternative is most protective of human health, the environment, the groundwater, and the workers.
- The preferred alternative for the 241-B-361 and 241-T-361 Settling Tanks is Alternative 2, Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation. This alternative provides protectiveness for the minor contamination assumed for this waste site after removal of the sludge.
- The preferred alternative for UPR-200-E-7 is Alternative 3, Removal, Treatment, and Disposal. This alternative is most protective of human health and the environment, is implementable, and is protective of workers.

The agencies believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost effective.

Representative Site 216-B-38 Trench and Its Analogous Waste Sites

Alternative 4, Capping, is the preferred alternative for representative site 216-B-38 Trench. The COCs include nitrate, nitrite, uranium, cesium-137, strontium-90, and technetium-99.

The 216-B-38 Trench is the representative site for the following waste sites:

- The 216-B-35 through 216-B-37 Trenches and the 216-B-39 through 216-B-41 Trenches
- The 216-T-14 through 216-T-17 Trenches
- The 216-T-21 through 216-T-25 Trenches.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-2.

Based on current conditions, the 216-B-38 Trench exceeds the groundwater protection PRGs for nitrate, nitrite, uranium, technetium-99, and uranium-233/234/238. The top of the contamination is 4.3 m (14 ft) below ground surface; therefore, the 0 to 4.6 m (0 to 15-ft) zone is associated with potential human health

Alternative 4, Capping, is the preferred alternative for analogous sites 216-B-35 through 216-B-37 and 216-B-39 through 216-B-41 Trenches, which are located in proximity to the 216-B-38 Trench representative site. The COCs are assumed to be similar to those of the representative waste site.

Alternative 4, Capping, is the preferred alternative for analogous sites 216-T-14 through 216-T-17 and 216-T-21 through 216-T-25 Trenches, which received a similar waste stream to that of the 216-B-38 Trench representative site. The COCs are assumed to be similar to those of the representative waste site.

risk from cesium-137 and ecological risk from cesium-137 and strontium-90. The contaminants at the base of the crib (at 14 ft below ground surface) would exceed PRGs associated with a potential intruder at 150 years. The 216-B-35 through 216-B-41 Trenches are located in proximity to and west of the 241-BX Tank Farm. The 216-T-14 through 216-T-17 Trenches are located to the northeast of the T Tank Farm. The 216-T-21 through 216-T-25 Trenches are located to the west of the TX Tank Farm (see Figures 1 through 6 at the end of the Proposed Plan). All of the waste sites analogous to the 216-B-38 Trench are assumed to pose a threat to groundwater and to present a significant risk to an intruder, who would inadvertently be exposed to the contaminated soils at depth. Some will pose human health risks from direct exposure and ecological risk if their contamination is located above 4.6 m (15 ft) below ground surface. Table B-4 summarizes the depth of clean fill for all the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 7.

Overall Protection of Human Health and the Environment - The 216-B-38 Trench, along with the 216-B-35 through 216-B-37, the 216-B-39 through 216-B-41, the 216-T-14 through 216-T-17, and the 216-T-21 through 216-T-25 Trenches obtain the most overall protection of human health and the environment through the implementation of Alternative 4, Capping, because:

- The exposure pathway is removed through the placement of the barrier
- Infiltration is reduced, which supports the protection of groundwater under RAO 2
- Intrusion is reduced by the design of the barrier, which would include intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced, because the workers would be exposed to the high doses. The approximate worker dose associated with the excavation alternatives is 1,560 rem.

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, limit the human health, environmental, and groundwater impacts by removing contaminants and disposing of them in an on-site engineered facility. However, Alternatives 3 and 5 present unacceptable levels of worker risk associated with exposure to contaminants and deep excavation activities for sites with high contaminant concentrations and deep contamination. Alternatives 3 and 5 at these types of sites also result in large volumes of waste requiring disposal. To remove all contaminants above PRGs under Alternative 3 would require removal as deep as 67.1 m (220 ft). This type of excavation is difficult, requires workers to be exposed to the high contaminant concentrations as well as risks associated with deep excavations, and has potential impacts on neighboring facilities such as the 216-B-57 Crib cap. This type of excavation is expensive and creates considerable waste that requires disposal. Alternative 5 would require removal of the most highly contaminated zones beneath the waste sites, as deep as 13.7 m (45 ft).

TABLE 7. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-38 AND ANALOGOUS SITES 216-B-35 THROUGH 216-B-37, 216-B-39 THROUGH 216-B-41, 216-T-14 THROUGH 216-T-17, AND 216-T-21 THROUGH 216-T-25

	ALTERNATIVES				
	❶ NO ACTION	❷ MESC, IC, MNA[a]	❸ RTD[b]	❹ CAPPING	❺ PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-38 Trench with 216-B-35 through 216-B-37 Trenches and 216-B-39 through 216-B-41 Trenches				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$15	$1,036,242	$6,394	$70,487
Operating and maintenance costs	$0	$3,703	$0	$4,742	$4,562
Present worth	$0	$3,718	$1,036,242	$11,136	$75,049
Analogous Sites 216-T-14 through 216-T-17 Trenches and 216-T-21 through 216-T-25 Trenches				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[c]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$16	$1,458,056	$6,490	$72,742
Operating and maintenance costs	$0	$3,758	$0	$4,812	$4,708
Present worth	$0	$3,774	$1,458,056	$11,302	$77,450

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. Toxicity, mobility, or volume through treatment

☑ Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: best satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: least satisfies criterion

Alternatives 1 and 2 are not protective of any of the waste sites, because constituents remain above the PRGs, even past 150 years. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternatives 1 and 2 do not comply with ARARs, because the waste sites currently exceed the RAOs. The ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of all contaminated material. Alternative 5 meets the ARARs through the removal of the high concentrations of contaminants at the bottom of the waste sites and the placement of an engineered barrier to address remaining contaminants. Alternative 4 meets the ARARs using an engineered barrier, which eliminates the exposure pathway, provides protection against intrusion, and limits infiltration to protect groundwater.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain after the institutional control period through 2150. Alternative 3 provides the most long-term effectiveness and permanence because contaminants above PRGs are removed from the site and disposed of at a suitable facility. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier. Alternative 4 reduces infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap augment the effectiveness of Alternative 4. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to show no further degradation based on the elevated nitrate, nitrite, uranium, and Tc-99 concentrations. Alternative 5 provides long-term effectiveness and permanence by removing the mass of higher concentration contaminants and capping the remaining contaminants to protect groundwater.

Short-term Effectiveness - Alternative 1 would be effective for workers in the short term, because the alternative does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) zone, human and ecological receptors may not be protected. Historical evidence indicates that the ecological receptors have played a role in dispersing contaminants from waste sites in the BC Cribs and Trenches area. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5. Alternatives 2 and 4 result in much lower risk to remediation workers than Alternatives 3 and 5. Alternatives 3 and 5 involve excavating contaminated soil and debris, resulting in significant short-term worker impacts during excavation, loading, transportation, and disposal of the materials because of the high concentrations associated with most of these waste sites. Risks to workers from potential exposure to contaminated soil and fugitive dust would be similar for Alternatives 3 and 5, in that both subject the workers to the highly contaminated areas at the bottom of the waste sites. Alternative 3 would present the greatest short-term risk to workers associated with both the contamination and the excavation activities as deep as 67 m (220 ft). Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites used to obtain capping materials would be disturbed. The waste sites have either limited habitat associated with highly disturbed gravel surfaces or monoculture habitats of planted wheatgrass. These latter habitats have shown some real diversity in recent studies on similar sites, such as the Gable Mountain Pond. The short-term impacts to vegetation and wildlife could be potentially high for Alternatives 3 and 5 because of the large volumes of borrow material needed to backfill the excavations and the timeframes needed to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the top of the contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternatives 3 and 5 but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except for natural attenuation. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived reduction, because these alternatives include a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented, because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is considered very complicated to implement because of high contamination and the depths of excavation that would be required. The high contamination levels in the soil at the bottom some waste sites would result in dose levels as high as 1,560 rem to workers and would require special techniques and protections to reduce these levels to an acceptable range. Alternative 3 would require significant downblending of removed soil with less contaminated soil to meet health and safety requirements and to meet waste acceptance criteria. This downblending requires a large volume of material to backfill and generates 5 to 10 times as much waste as a normal excavation. Approximately 1.9 million m^3 (2.5 million yd^3) of waste would be disposed of at ERDF. This represents approximately one third of the current capacity. In addition, excavation to depths required to meet PRGs would result in interferences with neighboring facilities such as the tank farms, underground piping, buildings, and utilities. Excavation is not practicable or cost effective at these depths, especially in light of the contamination levels. The excavation component of Alternative 5 is similar to that of Alternative 3 and is considered very difficult and hazardous to implement.

Cost - Capital costs and operating and maintenance costs are provided in Table 7. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 7 that are associated with Alternative 3 for the 216-B-38 Trench include full excavation of the contaminated material to meet PRGs. The costs in Table 7 that are associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs in Table 7 that are associated with Alternative 5 include excavation of contaminated soils as deep as 7.6 m (25 ft) or more, followed by an engineered barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-35 through 216-B-41 Trenches, the 216-T-14 through 216-T-17 Trenches, and the 216-T-21 through 216-T-25 Trenches is Alternative 4, Capping. This alternative is most protective of human health, the environment, the groundwater, and the workers.

The agencies believe that the preferred alternative is protective of human health and the environment, complies with ARARs, uses permanent solutions, protects workers, and is cost effective.

Representative Waste Site 216-B-57 Crib and Its Analogous Waste Sites

The 216-B-57 Crib is the representative sites for the following waste sites:

- The 216-B-50 Crib (this crib is one of the BY Cribs located north of the BY Tank Farm)
- The 216-B-11A and 216-B-11B French Drains
- The 216-B-62 Crib
- The 216-C-6 Crib
- The 216-S-9 Crib
- The 216-S-21 Crib
- UPR-200-W-108
- UPR-200-W-109.

Alternative 2, Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative for representative site 216-B-57 Crib because a Hanford Barrier currently exists at the site. The COCs include nitrate, nitrite, uranium, cesium-137, strontium-90, and technetium-99.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-3.

Based on current conditions (i.e., with the Hanford Barrier in place over the waste site), the 216-B-57 Crib satisfies both human health and ecological PRGs. If the barrier is not considered, then the site exceeds the human health PRGs for cesium-137 and radium-226 in the near-surface soils and the ecological PRGs for cesium-137 and strontium-90. Additionally, the groundwater protection PRGs are exceeded for technetium-99, because elevated concentrations are found throughout the soil column to nearly 54 m (177 ft) below ground surface.

Alternative 4, Capping, is the preferred alternative for analogous sites 216-B-50 Crib, 216-B-11A&B French Drains, 216-B-62 Crib, 216-C-6 Crib, 216-S-9 Crib, and 216-S-21 Crib. The COCs are assumed to be similar to the representative waste site.

The 216-B-57 Crib is located to the west of the BY Cribs and northwest of the BY Tank Farm. The 216-B-11A and 216-B-11B French Drains are located east of the 216-B-7A&B Cribs and north of the B Tank Farm. The 216-B-62 Crib is located south west of the BX Tank Farm. The 216-C-6 Crib is located in the vicinity of the former Semi-Works Plant (C Plant) near the center of the 200 East Area. The 216-S-9 Crib is located east of the SY Tank Farm. The 216-S-21 Crib is located west of the S Tank Farm. Unplanned release UPR-200-W-108 is associated with the 216-S-9 Crib. Unplanned release UPR-200-W-109 is located south of the 216-S-9 Crib (see Figures 1 through 6). The contaminant distributions for the waste sites analogous to the 216-B-57 Crib are expected to be similar to those of the 216-B-57

Alternative 3, Removal, Treatment, and Disosal, is the preferred alternative for analogous sites UPR-200-W-108 and UPR-200-W-109. The COCs are assumed to be similar to the representative waste site.

Crib. Likewise the risks are expected to be similar, with variations based on the site-specific depth of clean fill (see Table B-4) and quantity of effluent discharged.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 8.

Overall Protection of Human Health and the Environment - The 216-B-57 Crib obtains the most overall protection of human health and the environment through the implementation of Alternative 4, Capping; however, because the 216-B-57 Crib is already capped with a Hanford Barrier, Alternative 2, Maintain Existing Soil Barrier, Institutional Controls, and Monitored Natural Attenuation, is the preferred alternative, because:

- The exposure pathway is removed through the existing barrier
- Infiltration is reduced by the existing barrier, which supports RAO 2
- Intrusion is reduced by the design of the barrier, which includes intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced, because the workers would not be exposed to the high doses. The approximate worker dose is 10 rem associated with the excavation alternatives, compared to zero dose under Alternative 2.

Alternative 4 obtains the most overall protection of human health and the environment for the 216-B-50 Crib, the 216-B-11A and 216-B-11B French Drains, and the 216-B-62, 216-C-6, 216-S-9, and 216-S-21 Cribs, because:

- The exposure pathway is removed through the placement of a cap
- Infiltration is reduced by the cap, which supports RAO 2
- Intrusion is reduced due to the design of the barrier, which would include intrusion protection layers
- Institutional controls provide limitations on use around the barrier
- Worker risk is reduced, because the workers would not be exposed to the high doses. The approximate worker dose is 10 rem associated with the excavation alternatives, compared to minimal dose under Alternative 4 from removing aboveground structures.

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, limit the human health, environmental, and groundwater impacts by removing contaminants and disposing of them in an on-site engineered facility. However, Alternatives 3 and 5 present unacceptable levels of worker risk associated with exposure to contaminants and deep excavation activities for sites with high contaminant concentrations and deep contamination for all of the waste sites except UPR-200-W-108 and UPR-200-W-109. Alternatives 3 and 5 at sites with high contamination levels also result in large volumes of waste requiring disposal. To remove all contaminants above PRGs under Alternative 3 would require removal as deep as 67 m (220 ft). This type of excavation is difficult, requires workers to be exposed to the high contaminant concentrations as well as risks associated with deep excavations, and has the potential to impact neighboring facilities, such as the B Tank Farm in the case of the 216-B-11A and 216-B-11B French Drains. This type of excavation is expensive and creates considerable waste that requires disposal.

TABLE 8. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-57 AND ANALOGOUS SITES 216-B-50, 216-B-11A&B, 216-B-62, 216-C-9, 216-S-21, 216-S-9, UPR-200-W-108, AND UPR-200-W-109

	ALTERNATIVES				
	❶ NO ACTION	❷ MESC, IC, MNA[a]	❸ RTD[b]	❹ CAPPING	❺ PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-57 Crib[c]		✅			
Threshold Criteria					
Overall Protection	☐	☑	☑	☑	NA
Compliance with Laws	☐	☑	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◈	◆	◆	◆	NA
Short-term effectiveness	◆	◆	◈	◈	NA
Reduction in TMV[d]	◈	◈	◈	◈	NA
Implementability	◆	◆	◇	◆	NA
Cost (in thousands)					
Capital costs	$0	$15	$0	$0	NA
Operating and maintenance costs	$0	$687	$0	$0	NA
Present worth	$0	$702	NA[e]	NA[e]	NA[e]
Analogous Sites 216-B-50 Crib, 216-B-11A and 216-B=11B French Drains, 216-B-62 Crib, 216-C-6 Crib, 216-S-9 Crib, and 216-S-21 Crib				✅	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	◆
Short-term effectiveness	◈	◈	◇	◆	◇
Reduction in TMV[d]	◈	◈	◈	◈	◈
Implementability	◆	◆	◇	◆	◇
Cost (in thousands)					
Capital costs	$0	$60	$131,844	$4,189	$33,280
Operating and maintenance costs	$0	$4,142	$0	$5,248	$4,128
Present worth	$0	$4,202	$131,844	$9,437	$37,408
Analogous Sites Unplanned Release UPR-200-W-108 and UPR-200-W-109			✅		
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	NA
Compliance with Laws	☐	☐	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	NA
Short-term effectiveness	◈	◈	◈	◈	NA
Reduction in TMV[d]	◈	◈	◈	◈	NA
Implementability	◇	◇	◆	◈	NA
Cost (in thousands)					
Capital costs	$0	$15	$169	$373	NA
Operating and maintenance costs	$0	$394	$0	$335	NA
Present worth	$0	$409	$169	$708	NA

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. Costs for capping and partial removal/capping at 216-B-57 are included to support evaluation of analogous sites; a Hanford Barrier currently exists at the site.
d. Toxicity, mobility, or volume through treatment.
e. This site has Hanford Barrier therefore, this alternative is NA.

✅ Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: best satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: least satisfies criterion

Alternative 5 would require removal of the most highly contaminated zones beneath the waste sites, as deep as 13.7 m (45 ft).

Alternative 3 does obtain the most overall protection of human health and the environment at UPR-200-W-108 and UPR-W-109, which are small, shallow unplanned release sites.

Alternative 1 is not protective of any of the waste sites, as constituents remain above the PRGs, even past 150 years. Alternative 2 is only protective at the 216-B-57 Crib because of the Hanford Barrier installed there. Alternative 2 is not protective at the other sites, because constituents remain above the PRGs, even past 150 years. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternatives 1 and 2 generally do not comply with ARARs, because the waste sites currently exceed the RAOs. However, for the 216-B-57 Crib, Alternative 2 complies with ARARs by the placement of the Hanford Barrier, because the barrier eliminates exposure to contaminants and limits infiltration, which provides groundwater protection. The ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of all contaminated material. Alternative 5 meets the ARARs through the removal of the high concentrations of contaminants at the bottom of some waste sites and the placement of an engineered barrier to address remaining contaminants. Alternative 4 meets the ARARs using an engineered barrier, which eliminates the exposure pathway, provides protection against intrusion, and limits infiltration to protect groundwater.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 generally do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain after the institutional controls period through 2150. Alternative 2 does provide long-term effectiveness and permanence for the 216-B-57 Crib. Alternative 3 provides the most long-term effectiveness and permanence because contaminants above PRGs are removed from the site and disposed to a suitable facility. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier. Alternative 4 reduces infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap augment the effectiveness of Alternative 4. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to show no further degradation based on the elevated nitrate, nitrite, uranium, and technetium-99 concentrations. Alternative 5 provides long-term effectiveness and permanence by removing the mass of higher concentration contaminants and capping the remaining contaminants to protect groundwater.

Short-term Effectiveness - Alternative 1 would be effective for workers in the short term, because it does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) zone, human and ecological receptors may not be protected. Historical evidence indicates that the ecological receptors have played a role in dispersing contaminants from waste sites in the BC Cribs and Trenches area. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5. Alternatives 2 and 4 have lower risk to remediation workers than Alternatives 3 and 5. Alternatives 3 and 5 involve excavating contaminated soil and debris, resulting in significant short-term worker impacts during excavation, loading, transportation, and disposal of the materials because of the high concentrations associated with most of these waste sites. Risks to workers from potential exposure to contaminated soil and fugitive dust would be similar for Alternatives 3 and 5, in that both subject the workers to the highly contaminated areas at the bottom of the waste sites. Alternative 3 would present the greatest short-term risk to workers associated with both the contamination and the excavation activities as deep as 67.1 m (220 ft). Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites used to obtain capping materials would be disturbed. The waste sites have either limited habitat associated with highly disturbed gravel surfaces or monoculture habitats of planted wheatgrass. These latter habitats have shown some real diversity in recent studies on similar sites, such as the Gable Mountain Pond. The short-term impacts to vegetation and wildlife potentially could be high for Alternatives 3 and 5 because of the large volumes of borrow material needed to backfill the excavations and the timeframes needed to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the top of the contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternatives 3 and 5 but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except for natural attenuation. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived reduction, because these alternatives include a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be implemented easily because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 4 is considered readily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site, and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is considered very complicated to implement because of high contamination and the depths of excavation that would be required. The high contamination levels in the soil at the bottom of the waste site would result in dose levels as high as 10 rem to workers and may require special techniques and protections to reduce these levels to an acceptable range. Alternative 3 would require significant downblending of removed soil with less-contaminated soil to meet health and safety requirements and to meet waste acceptance criteria. This downblending requires a large volume of material to backfill and generates 5 to 10 times as much waste as a normal excavation. Approximately 2.5 million yd^3 of waste would be disposed of at ERDF. This represents approximately one third of the current capacity. In addition, excavation to depths required to meet PRGs would result in interferences with neighboring facilities such as the tank farms, underground piping, buildings, and utilities. Excavation is neither practicable nor cost effective at these depths, especially in light of the contamination levels. The excavation component of Alternative 5 is *similar to Alternative 3 and is considered very difficult and hazardous to* implement.

Cost - Capital costs and operating and maintenance costs are provided in Table 8. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 8 that are associated with Alternative 3 for the 216-B-57 Crib include full excavation of the contaminated material. The costs in Table 8 that are associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs in Table 8 that are associated with Alternative 5 include excavation of contaminated soils as deep as 7.6 m (25 ft) or more, followed by construction of an engineered barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-57 Crib is Alternative 2, Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation. The existing Hanford Barrier was constructed over this waste site and is most protective of human health and the environment. Alternative 2 would continue the maintenance and monitoring of the existing cap.
- The preferred alternative for the 216-B-50, 216-B-62, 216-C-6, 216-S-9, and 216-S-21 Cribs, and the 216-B-11A and 216-B-11B French Drains is Alternative 4, Capping. This alternative is most protective of human health, the environment, the groundwater, and the workers.
- The preferred alternative for UPR-200-W-108 and UPR-200-W-109 is Alternative 3, Removal, Treatment, and Disposal. This alternative is most protective of human health and the environment, is implementable, and reduces long-term maintenance requirements.

The agencies believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost effective.

Representative Site 216-B-58 Trench and Its Analogous Waste Sites

The 216-B-58 Trench is the representative site for the 216-B-53A, 216-B-53B, and 216-B-54 Trenches, all of which are located in the BC Cribs and Trenches area.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B, Table B-1.

Based on current conditions, the 216-B-58 Trench exceeds the human health PRGs for cesium-137 in the near surface soils; the ecological PRGs for selenium, aroclor-1254 (a polychlorinated biphenyl, or PCB), cobalt-60, cesium-137, and strontium-90; and the groundwater protection PRGs for selenium and nitrate. The waste site will reach acceptable levels for cesium-137 at 287 years. Characterization work was performed at the 216-B-58 Trench in 2003; the information from that

PCB
Polychlorinated biphenyl – a class of contaminants with long life in the environment that pose a risk to human and ecological receptors and to groundwater.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for representative site 216-B-58 Trench. The COCs include selenium, aroclor-1254, nitrate, cobalt 60, cesium-137, and strontium-90.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for analogous sites 216-B-53A, 216-B-53B, and 216-B-54 Trenches, which are located in proximity to the 216-B-58 Trench representative site. The COCs are assumed to be similar to those of the *representative waste site for* the 216-B-53B and 216-B-54 Trenches. The 216-B-53A Trench may have received 100 grams of plutonium. This site will require confirmatory sampling to determine the presence of transuranic constituents above 100 nCi/g.

characterization is included in the feasibility study (DOE/RL-2003-64), including risk assessment for human health, ecological, and groundwater protection.

Alternative Evaluations

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 9.

Overall Protection of Human Health and the Environment - The 216-B-58 Trench obtains the most overall protection of human health and the environment through the implementation of Alternative 3, Removal, Treatment, and Disposal. Contaminants above PRGs are removed, thereby protecting humans, ecology, and the groundwater. Worker risks are low because of lower contamination levels. The approximate worker dose associated with the excavation alternative is 0.04 rem.

Alternative 4, Capping, is protective by placement of an engineered barrier, which eliminates exposure, reduces infiltration, and provides for intrusion protection.

Alternative 5, Partial Removal, Treatment, and Disposal with Capping is not applicable at the 216-B-58 Crib or its analogous sites because the contamination is relatively shallow and complete excavation can be accomplished without undue risk.

Alternatives 1 and 2 are not protective of any of the waste sites, because constituents remain above the PRGs, even past 150 years. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Compliance with ARARs - Alternatives 1 and 2 do not comply with ARARs, because the waste sites currently exceed the RAOs. The ARARs are met for Alternatives 3 and 4. Alternative 3 meets the ARARs through the removal of all contaminated material. Alternative 5 meets the ARARs through the removal of the high concentrations of contaminants at the bottom of the waste sites and the placement of an engineered barrier to address remaining contaminants. Alternative 4 meets the ARARs using an engineered barrier, which eliminates the exposure pathway, provides protection against intrusion, and limits infiltration to protect groundwater.

Long-term Effectiveness and Permanence - Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain following industrial land use through 2150. Alternative 3 provides the most long-term effectiveness and permanence because contaminants above PRGs are removed from the site and disposed of at a suitable facility. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier. Alternative 4 reduces infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap augment the effectiveness of Alternative 4. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to show that no further degradation occurs.

Short-term Effectiveness - Alternative 1 would be effective for workers in the short term, because the alternative does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) zone, human and ecological receptors may not be protected. Historical evidence

TABLE 9. COMPARISON OF ALTERNATIVES FOR REPRESENTATIVE SITE 216-B-58 AND ANALOGOUS SITES 216-B-53A, 216-B-53B, AND 216-B-54

	ALTERNATIVES				
	1 NO ACTION	2 MESC, IC, MNA[a]	3 RTD[b]	4 CAPPING	5 PARTIAL REMOVAL/ CAPPING
Representative Site 216-B-58 Trench			☑		
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	NA
Compliance with Laws	☐	☐	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	NA
Short-term effectiveness	◈	◈	◈	◆	NA
Reduction in TMV[c]	◈	◈	◈	◈	NA
Implementability	◆	◆	◆	◆	NA
Cost (in thousands)					
Capital costs	$0	$15	$1,531	$958	NA
Operating and maintenance costs	$0	$680	$0	$745	NA
Present worth	$0	$695	$1,531	$1,703	NA
Analogous Sites 216-B-53A Trench[d], 216-B-53B Trench, and 216-B-54 Trench			☑		
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	NA
Compliance with Laws	☐	☐	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◆	NA
Short-term effectiveness	◈	◈	◈	◆	NA
Reduction in TMV[c]	◈	◈	◈	◈	NA
Implementability	◆	◆	◆	◆	NA
Cost (in thousands)					
Capital costs	$0	$46	$4,820	$2,862	NA
Operating and maintenance costs	$0	$2,030	$0	$2,918	NA
Present worth	$0	$2,076	$4,820	$5,780	NA

a. Maintain existing soil cover, institutional controls, monitored natural attenuation
b. Removal, treatment, and disposal
c. Toxicity, mobility, or volume through treatment
d. 216-B-53A Trench received 100 g Pu; therefore the Hanford Barrier is assumed in the cost estimate.

☑ Indicates the preferred alternative
☑ Yes, meets criterion
☐ No, does not meet criterion
◆ High: best satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: least satisfies criterion

indicates that the ecological receptors have played a role in dispersing contaminants from waste sites in the BC Cribs and Trenches area. Alternatives 2 and 4 would be more effective in the short term than Alternative 3, predominantly because of their lower risk to remediation workers. Alternative 3 involves excavating contaminated soil and debris, resulting in short-term worker impacts during excavation, loading, transportation, and disposal of the materials; however, because the contaminant concentrations associated with these waste sites likely are low, risks are expected to be low. Radiological dose to workers from excavation of contaminated soil at the 216-B-58 Trench was estimated at 0.04 rem. The 216-B-53A Trench, which contains plutonium, can be excavated safely because that contaminant is expected to be confined to a thin layer of soil and controls to protect workers are established. Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites used to obtain the capping materials would be disturbed. The waste sites have either limited habitat associated with highly disturbed gravel surfaces or monoculture habitats of planted wheatgrass. These latter habitats have shown some real diversity in recent studies on similar sites, such as the Gable Mountain Pond. The short-term impacts to vegetation and wildlife are considered moderate for Alternative 3 because of the borrow material needed to backfill the excavations and the timeframes needed to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the top of the contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternative 3 but is not anticipated, because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except by natural attenuation. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternatives 3 provides an additional perceived reduction, because it includes a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 4 is considered readily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site, and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is readily implementable because of the relatively shallow depths (i.e., 7.6 m [25 ft] at the 216-B-58 Trench) of excavation that would be required. The contamination levels in the soil at the bottom of the waste site would result in dose levels of up to 0.04 rem to workers, which would not likely require many special techniques and protections to reduce these levels to an acceptable range. Alternative 3 may require modest downblending of removed soil with less-contaminated soil to meet health and safety requirements and to meet waste acceptance criteria.

Cost - Capital costs and operating and maintenance costs are provided in Table 9. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 9 that are associated with Alternative 3 for the 216-B-58 Trench include full excavation of the contaminated material to meet PRGs. The costs in Table 9 that are associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. Alternative 5 is not applicable to these waste sites, because contamination is shallow.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-58, 216-B-53A, 216-B-53A, and 216-B-54 is Alternative 3, Removal, Treatment, and Disposal. This alternative is most protective of human health, the environment, the groundwater, and workers.

The agencies believe that the preferred alternative is protective of human health and the environment, complies with ARARs, uses permanent solutions, protects workers, and is cost effective.

PLUG-IN OF 200-TW-1, 200-TW-2, AND 200-PW-5 OPERABLE UNIT WASTE SITES

The plug-in approach is a process that helps make remedial action decisions for additional waste sites using existing CERCLA evaluations. In the future, the plug-in approach is proposed for any similar waste sites already defined within the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units and for newly discovered waste sites that have a conceptual site model similar to that of those for the representative waste sites already addressed in this Proposed Plan. The plug-in approach will be used on the analogous sites considered in the feasibility study after additional data are collected in the confirmatory and design sampling phases.

The plug-in approach supports the goal of remediating waste sites within the operable units in conjunction with the analogous site approach. The traditional CERCLA approach for remedy selection would require the development of multiple proposed plans and RODs that, for similar sites, would be nearly identical to the feasibility studies, proposed plans, and RODs already developed and proven to be successful. The plug-in approach allows remedial actions to begin much more quickly at a waste site, without the need for redundant remedy selection processes.

The plug-in approach requires three main elements to establish its use as a cost-effective tool for remediation.

- First, multiple sites must be identified that share common physical and contaminant characteristics. These characteristics are referred to as the conceptual site model.
- Second, a remedial alternative, or standard remedy, must be established that has been shown to be protective and cost-effective for sites that share the common conceptual site model.
- Lastly, sites sharing a common conceptual site model must be shown to require remedial action because of contaminant concentrations that pose risk to human health and the environment.

To use the plug-in approach for a waste site not evaluated in the feasibility study, a site must fit the defined conceptual model and must be shown to require remedial action. The site then can be "plugged in" to the standard remedy. The following information describes how the plug-in approach is proposed to be used for remedy selection.

Establishing the Conceptual Site Model

Five conceptual site models have been defined based on the site characteristics contained in the feasibility study. These characteristics include:

- Type of contaminant inventory,
- Concentrations of contaminants in environmental media,
- Types of contaminated environmental media (soil) or material (e.g., concrete, metal, wood),
- Extent of contamination within the environment (that is, the depth of discharge, the expected contaminant distributions, and the potential for hydrologic and contaminant impacts to groundwater).

Based on the representative sites evaluated in the feasibility study, the following five conceptual site models were developed:

- Waste sites where no hazardous material was disposed of or where contaminants disposed of currently meet the RAOs.
- Waste sites where limited contamination exists at the waste sites, an existing soil cover is in place and of sufficient thickness to provide protection, contaminants are expected to meet the RAOs during the institutional control period (such as within 150 years), and groundwater PRGs are not exceeded. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- Waste sites where contaminants exceed the RAOs and contamination is shallow and low-volume and can be cost-effectively remediated through removal, treatment, and disposal. Typically, these contaminants exceed the human health and ecological PRGs; however, groundwater PRGs are not exceeded at depths that make excavation impracticable. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- Waste sites where contaminants exceed the PRGs, where contaminants are at concentrations that pose a significant worker risk, and where the contaminants having potential to adversely impact groundwater are at significant depth. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- Waste sites where contaminants exceed the PRGs, where contaminants are at concentrations that would not pose a significant worker risk, and where the contaminants having potential to adversely impact groundwater are at significant depth. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.

Establishment of the Standard Remedy

The standard remedies, based on the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites, have been defined on the basis of the conceptual models presented by the representative waste sites, as well as on the alternative evaluations conducted for all waste sites. As such, five standard remedies are identified for potential plug-in sites. These remedies are highlighted below along with their required characteristics.

- **Alternative 1: No Action** has been defined as a standard remedy for waste sites whose conceptual site model indicates that no hazardous materials were disposed of at the waste site or that contaminants disposed of currently meet the RAOs.
- **Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation** has been defined as the standard remedy for waste sites whose conceptual site model indicates that limited contamination exists at the waste sites, an existing soil cover is in place and of sufficient thickness to provide protection, contaminants are expected to meet the RAOs during the institutional control period (such as within 150 years), and groundwater PRGs are not exceeded. Contaminated environmental media are similar to the media exhibited by the waste sites included in this Proposed Plan. The media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- **Alternative 3: Removal, Treatment, and Disposal** has been defined as the standard remedy for waste sites whose conceptual site model indicates that contaminants exceed the RAOs and that contamination is shallow and low-volume and can be cost-effectively remediated through the removal, treatment, and disposal of contaminated media. Typically, as shown in the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites, these contaminants exceed the human health and ecological PRGs; however, groundwater PRGs are not exceeded at depths that make excavation impracticable. Contaminated environmental media are similar to the media exhibited by the waste sites included herein. The media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- **Alternative 4: Capping** has been defined as the standard remedy for waste sites whose conceptual site model indicates that contaminants exceed the RAOs and that the contaminants at greater depths have a potential to adversely impact groundwater. Contaminant concentrations and contaminated environmental media are similar to the media exhibited by the waste sites included in this Proposed Plan. These media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes. Contaminant concentrations would indicate the potential to adversely impact groundwater and would pose significant worker protection and intruder risk. Contaminants also may pose a risk to humans and ecological receptors, depending on the depth to the top of the contamination.
- **Alternative 5: Partial Removal, Treatment, and Disposal with Capping** has been defined as the standard remedy for waste sites where contaminants exceed the PRGs, where contaminants in the near-surface are at concentrations that would not pose a significant worker risk but that would result in substantial risk reduction, and where the contaminants having potential to adversely impact groundwater are at significant depth. The contaminants that can be readily excavated would be removed, and the remaining contaminants would be capped to provide groundwater protection. Contaminant

concentrations and contaminated environmental media generally are less than the media exhibited by the waste sites included in this Proposed Plan; however, the concentrations are high enough to result in real risk reduction in the near-surface without exposing workers to unacceptable risks. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes. Cost analysis would be required to ensure that this alternative is cost-effective when compared to either Alternative 3 or Alternative 4.

Establishing the Need for Remedial Action

Waste sites that share a common conceptual site model will "plug-in" to the standard remedy if they are determined to require remedial action because of a risk to human health and the environment (based on the defined RAOs and associated PRGs, as defined previously). Some of the waste sites in the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units likely will require confirmatory sampling to validate the conceptual site model and the identified preferred remedy. The preferred remedy will be implemented following confirmation of the conceptual site model. Should the confirmatory sampling indicate variations in the defined conceptual site model, this plug-in approach will be used to define the appropriate remedy.

Public Involvement in the Plug-In Approach

To ensure that the public is involved in the application of the plug-in approach, the Tri-Parties will publish explanations of significant differences at the following points in the plug-in process:

- When newly discovered waste sites are proven through analysis to be above remediation goals and can plug-in to the standard remedy
- When confirmatory sampling identified for the waste sites discussed herein indicates variations in the defined conceptual site model such that the preferred remedy is no longer protective.

Public Comment Period:
March XX - April XX, 2004

Public Meetings:
As requested

Information Repositories
This Proposed Plan is available for viewing at the following public information repositories:

University of Washington
Suzzallo Library Government Publications
Seattle, Washington 98195
206/543-1937
ATTN: Eleanor Chase

Gonzaga University
Foley Center
East 502 Boone
Spokane, Washington 99258
509/323-3839
ATTN: Connie Scarpelli

Portland State University
Branford Price Millar Library
934 SW Harrison
Portland, Oregon 97207-1151
503/725-3690
ATTN: XXXXXX

Washington State University
Consolidated Information Center
U.S. Department of Energy Public Reading Room
Room 101L
2770 University Drive
Richland, Washington 99352
509/372-7443
ATTN: Terri Traub

COMMUNITY PARTICIPATION

Public Involvement

Citizens are encouraged to get involved in decision making for the Hanford Site and specifically the 200-TW-1, 200-TW-2, and 200-PW-5 Operable Unit waste sites by reviewing this Proposed Plan and related documents, attending a public meeting or briefing, and providing feedback to the Tri-Parties.

Public Meetings

Members of the public may request a meeting to provide oral comments or to receive an explanation of the remedial alternatives presented in the Proposed Plan by contacting John Price at the Washington State Department of Ecology. To provide adequate notice for all Hanford stakeholders, public meeting requests should be received by TBD.

Submitting Comments

The Tri-Parties will accept written comments on the Proposed Plan at any time during the 30-day public comment period. Please send written comments to John Price at the Washington State Department of Ecology via:

- mail: 1315 West 4th Avenue, Kennewick, WA 99336
- fax: (509) 736-3030
- email: jpri461@ecy.wa.gov

For more information, please consult the Administrative Record in the locations specified below.

Administrative Record

The Administrative Record can be reviewed at the following location:
Lockheed Martin Information Technology
Administrative Record
2440 Stevens Center Place, Room 1101
Richland, Washington 99352
ATTN: Debbi Isom
(509) 376-2530

Points of Contact

Washington State Department of Ecology
John Price, Project Manager
(509) 736-3029

U.S. Department of Energy Representative
Bryan Foley, Project Manager
(509) 376-7087

U.S. Environmental Protection Agency Representative (Region 10)
Craig Cameron, Project Manager
(509) 376-8665

FIGURE 1. LOCATION OF THE HANFORD SITE AND THE 200-TW-1, 200-TW-2, AND 200-PW-5 OPERABLE UNIT WASTE SITES.

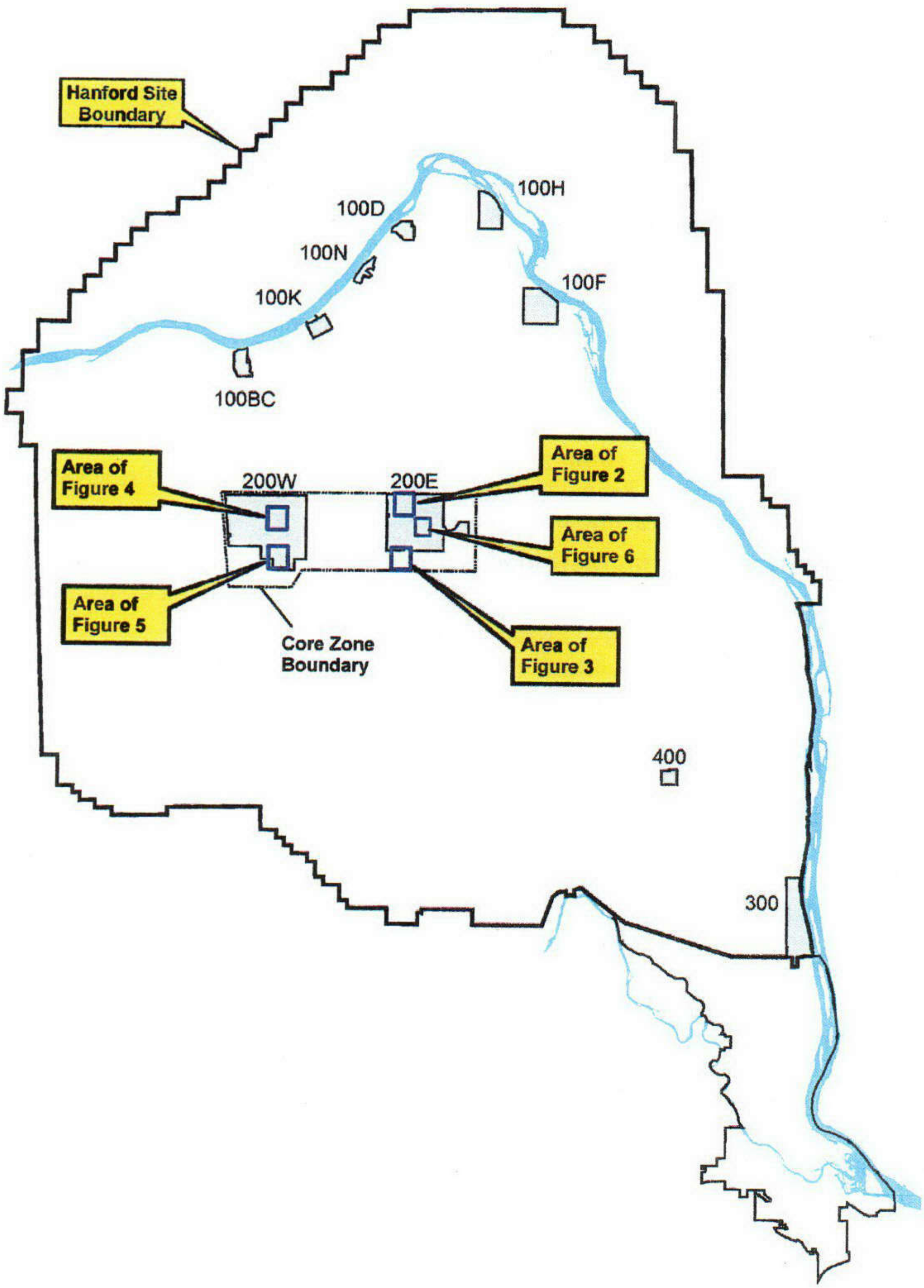


FIGURE 2. LOCATION OF THE 200-TW-1, 200-TW-2, AND 200-PW-5 OPERABLE UNIT WASTE SITES IN THE 200 EAST AREA.

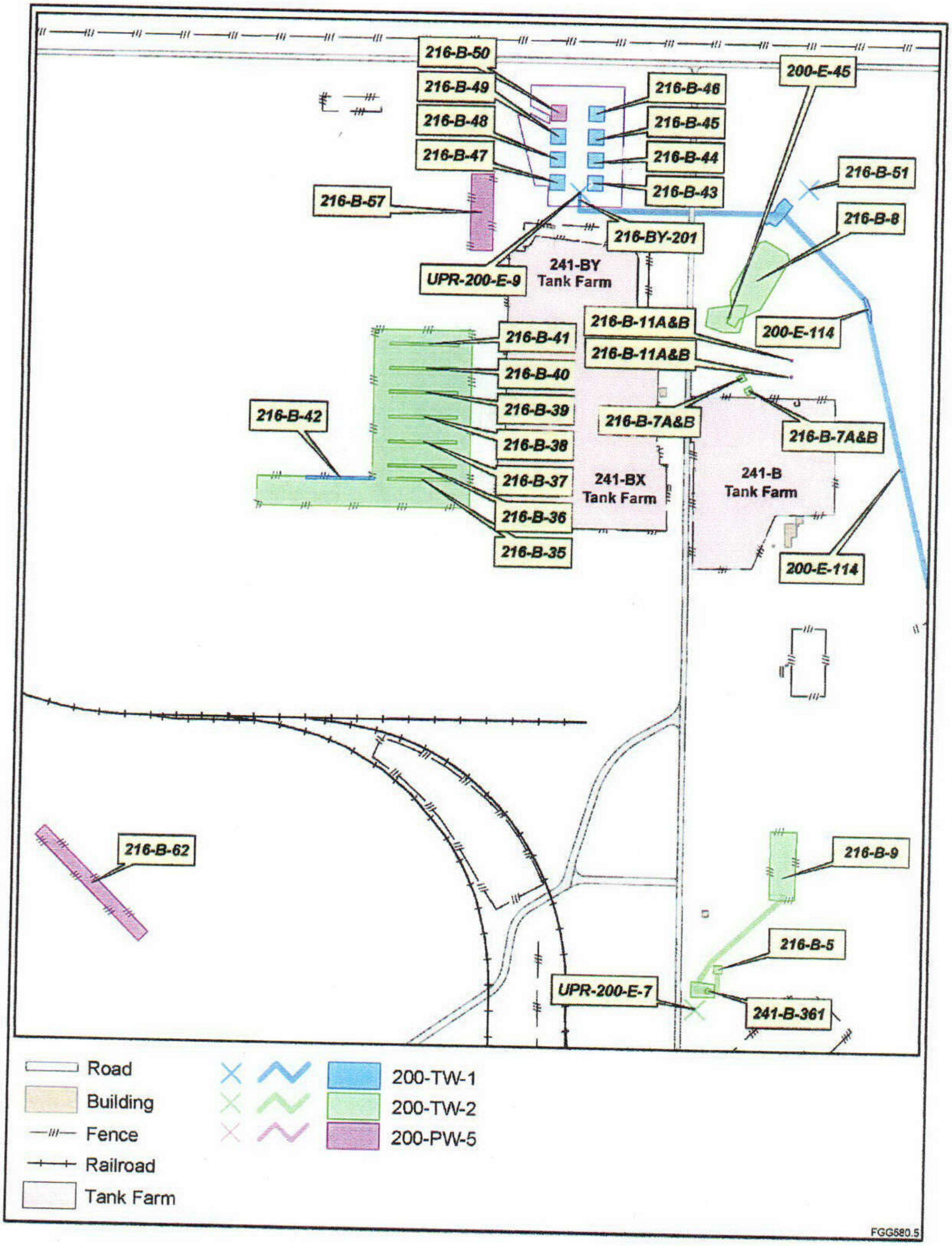


FIGURE 3. LOCATION OF THE 200-TW-1 OPERABLE UNIT WASTE SITES SOUTH OF THE 200 EAST AREA.

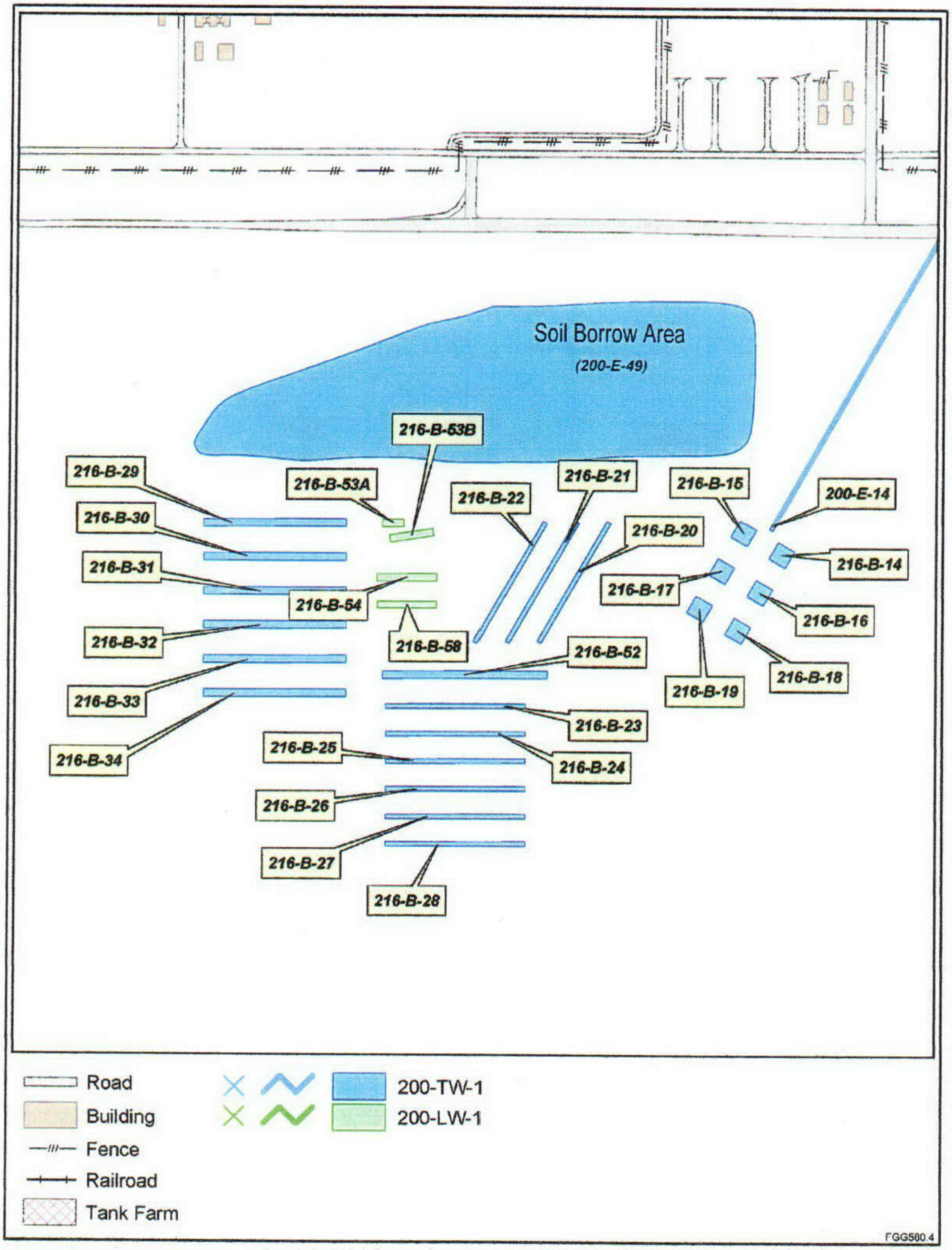


FIGURE 4. LOCATION OF THE 200-TW-1 AND 200-TW-2 OPERABLE UNIT WASTE SITES IN THE 200 WEST AREA.

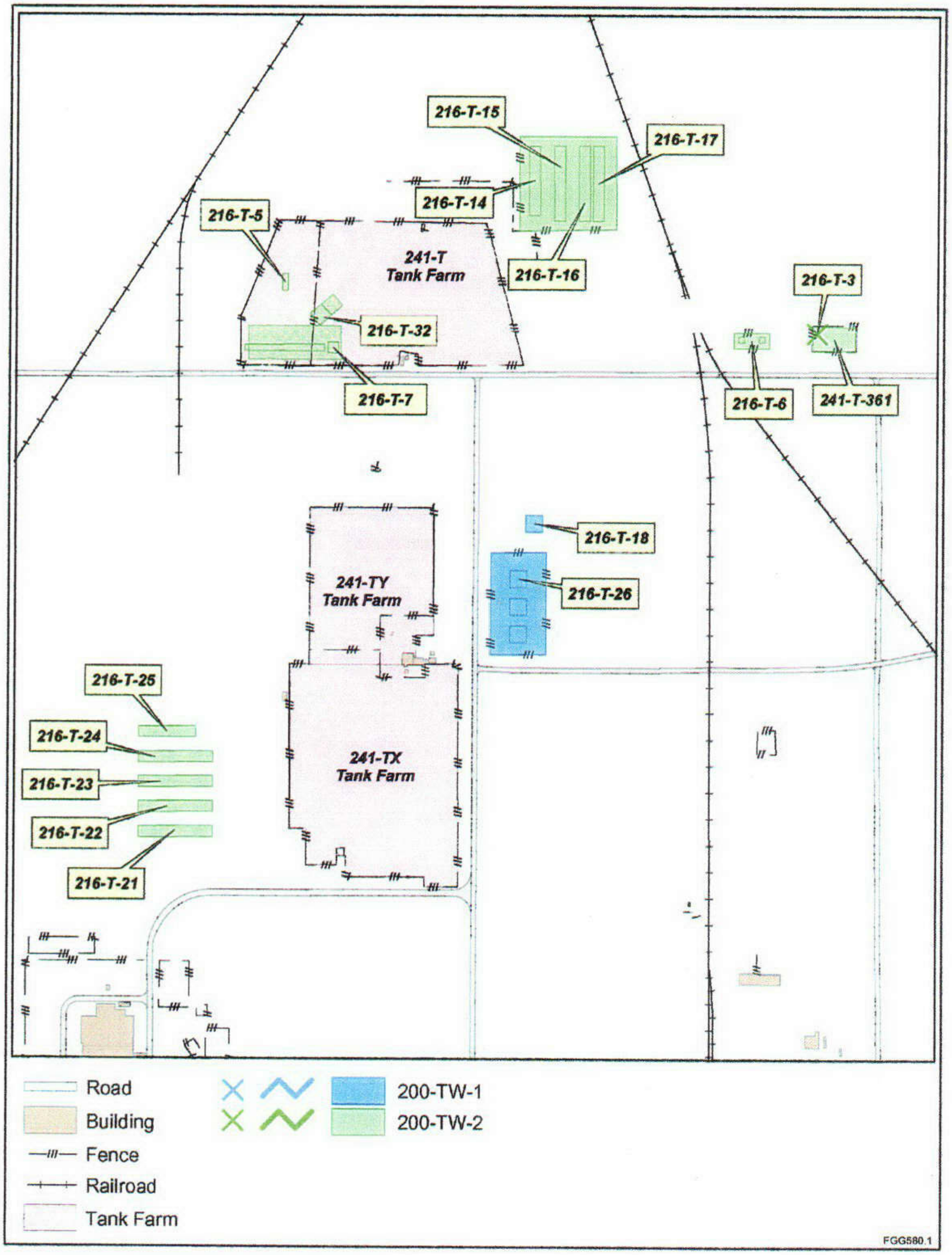


FIGURE 5. LOCATION OF THE 200-PW-5 OPERABLE UNIT WASTE SITES IN THE 200 WEST AREA.

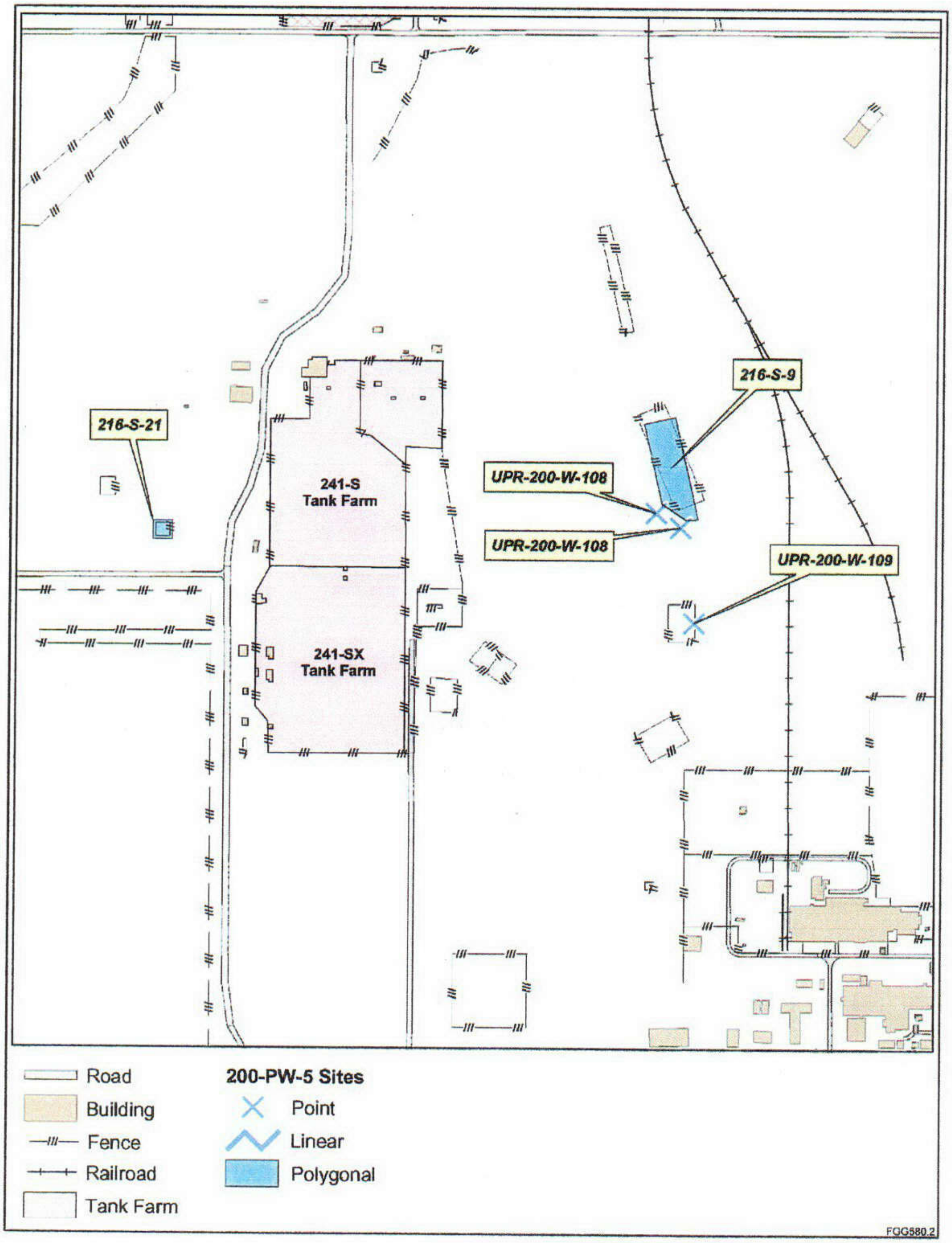
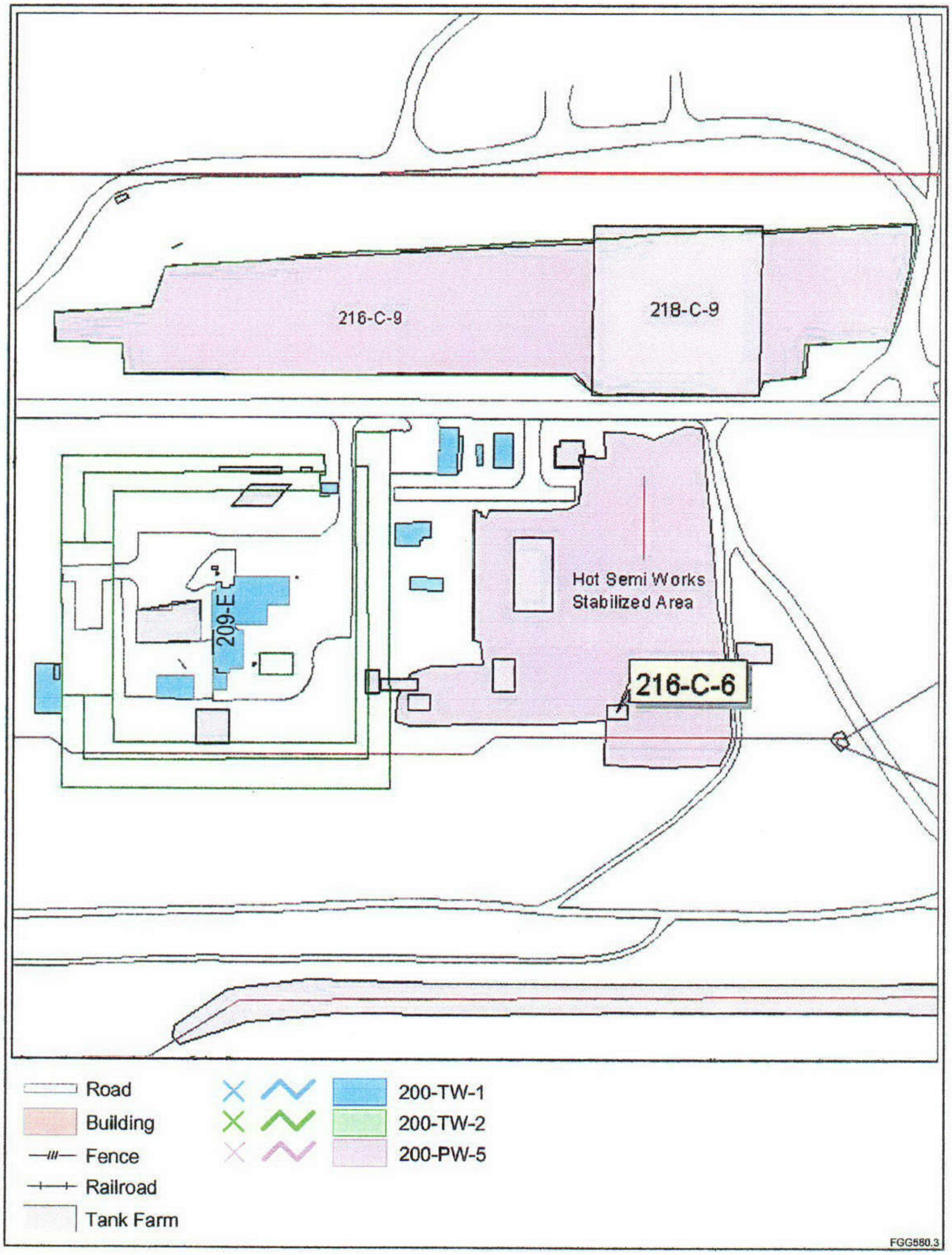


FIGURE 6. LOCATION OF THE 200-PW-5 OPERABLE UNIT WASTE SITES IN THE 200 EAST AREA.



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APPENDIX A

COST ESTIMATE DETAILS

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Table A-1. Net Present Worth Cost Estimates (in $1,000). (4 Pages)

WASTE SITE/GROUP	ALTERNATIVE 1: No Action	ALTERNATIVE 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALTERNATIVE 3: Removal, Treatment, and Disposal	ALTERNATIVE 4: Capping	ALTERNATIVE 5: Partial Removal, Treatment, and Disposal with Capping
REPRESENTATIVE SITE					
216-T-26 Crib	-	$686	$39,576	$1,126	$2,070
Analogous Sites to be Evaluated by the 216-T-26 Crib Model					
216-T-18 Crib	-	$686	$39,576	$1,126	$2,070
REPRESENTATIVE SITE					
216-B-46 Crib Remediated as a group consisting of 216-B-43, 216-B-44, 216-B-45, 216-B-47, 216-B-48, 216-B-49 Cribs and the 216-B-50 Crib, which is analogous to 216-B-57 Crib but located in this crib group	-	$1,728	$399,703	$5,548	$21,793
Analogous Sites to be Evaluated by the 216-B-46 Crib Model					
Remediated as a group consisting of 216-B-14, 216-B-15, 216-B-16, 216-B-17, 216-B-18, 216-B-19 Cribs	-	$2,535	$259,270	$8,138	$35,282
200-E-114 Pipeline	-	$1,711	$59,579	$5,492	NA
200-E-14 Siphon Tank[1]	-	$6,124	$6,488	$7,327	NA
UPR-200-E-9 Unplanned Release[2]	-	$406	$227	$653	NA
Remediated as a group consisting of 216-B-20, 216-B-21, 216-B-22 Trenches	-	$3,222	$571,993	$10,341	$40,447
Remediated as a group consisting of 216-B-23, 216-B-24, 216-B-25, 216-B-26, 216-B-27, 216-B-28, 216-B-52 Trenches	-	$10,225	$1,103,818	$32,820	$144,899
Remediated as a group consisting of 216-B-29, 216-B-30, 216-B-31, 216-B-32, 216-B-33, 216-B-34 Trenches	-	$10,048	$1,056,013	$32,254	$110,423
216-B-42 Trench[2]	-	$475	$244,979	$874	$915
216-B-51 French Drain[2]	-	$405	$150,388	$649	NA
216-BY-201 Settling Tank[1]	-	$6,124	$6,488	$7,327	NA
REPRESENTATIVE SITE					
216-B-5 Injection/Reverse Well	-	$914	$102,830	$1,627	NA
Analogous Sites to be Evaluated by the 216-B-5 Injection/Reverse Well Model					
216-T-3 Injection/Reverse Well	-	$914	$49,552	$1,627	NA
REPRESENTATIVE SITE					

Table A-1. Net Present Worth Cost Estimates (in $1,000). (4 Pages)

WASTE SITE/GROUP	ALTERNATIVE 1: No Action	ALTERNATIVE 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALTERNATIVE 3: Removal, Treatment, and Disposal	ALTERNATIVE 4: Capping	ALTERNATIVE 5: Partial Removal, Treatment, and Disposal with Capping
216-B-7A, and 216-B-7B Cribs	-	$683	$244,003	$2,168	$1,917
Analogous Sites to be Evaluated by the 216-B-7A Crib Model					
216-B-8 Crib[3]	-	$419	$395,276	$1,013	$4,272
216-B-9 Crib[3]	-	$2,906	$140,140	$7,017	$18,740
241-B-361 Settling Tank[4]	-	$6,681	$7,078	$7,993	NA
200-E-45 Sampling Shaft[2,3]	-	$419	$118,482	$682	$688
UPR-200-E-7 Unplanned Release[2,3]	-	$412	$265	$664	NA
216-T-5 Trench[2,3]	-	$522	$130,334	$930	$1,387
216-T-6 Crib[2]	-	$604	$243,080	$1,280	$695
216-T-7 Crib[3]	-	$6,094	$414,252	$14,716	$38,873
216-T-32 Crib[2]	-	$604	$243,251	$1,280	$622
241-T-361 Settling Tank[6]	-	$6,681	$7,078	$7,993	NA
REPRESENTATIVE SITE					
216-B-38 Crib Remediated as a group consisting of 216-B-35, 216-B-36, 216-B-37, 216-B-39, 216-B-40, 216-B-41 Trenches	-	$3,718	$1,036,242	$11,136	$75,049
Analogous Sites to be Evaluated by the 216-B-38 Trench Model					
Remediated as a group consisting of 216-T-14, 216-T-15, 216-T-16, 216-T-17 Trenches	-	$1,517	$664,358	$4,543	$31,370
Remediated as a group consisting of 216-T-21, 216-T-22, 216-T-23, 216-T-24, 216-T-25 Trenches	-	$2,257	$793,698	$6,759	$46,080
REPRESENTATIVE SITE					
216-B-57 Crib	-	$702	NA	NA	NA
Analogous Sites to be Evaluated by the 216-B-57 Crib Model[7]					
216-B-11A and 216-B-11B French Drains[2]	-	$419	$17,408	$682	$3,797
216-C-6 Crib[2]	-	$452	$11,249	$760	$221
216-B-62 Crib	-	$1,170	$43,548	$2,826	$11,523
216-S-21 Crib[2]	-	$464	$12,938	$791	$909
216-S-9 Crib	-	$1,697	$46,701	$4,378	$20,958
UPR 200-W-108 and UPR 200-W-109		$409	$169	$708	NA
REPRESENTATIVE SITE					

Table A-1. Net Present Worth Cost Estimates (in $1,000). (4 Pages)

WASTE SITE/GROUP	ALTERNATIVE 1: No Action	ALTERNATIVE 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALTERNATIVE 3: Removal, Treatment, and Disposal	ALTERNATIVE 4: Capping	ALTERNATIVE 5: Partial Removal, Treatment, and Disposal with Capping
216-B-58 Trench	-	$695	$1,531	$1,703	NA
Analogous Sites to be Evaluated by the 216-B-58 Trench Model					
216-B-53A Trench[8]	-	$1,034	$1,747	$3,226	NA
216-B-53B Trench	-	$486	$1,410	$1,192	NA
216-B-54 Trench	-	$556	$1,663	$1,362	NA

NOTES:

[1]Cost is equal to the 241-B-361 Settling Tank multiplied by a factor of 5.5/6 because of the difference in cost of sludge removal. The costs of sludge removal were obtained from DOE/RL-2003-52 ($6M for 241-B-361 and 241-T-361Settling Tanks and $5.5M for 200-E-14 Siphon Tank and 216-BY-201 Settling Tank).

[2]Costs for Alternative 2 and 4 are based on a ratio cost to the representative site plus a minimum cost. The minimum cost is the lowest cost anticipated to complete the alternatives. For Alternative 2, the minimum cost is $404,575. For Alternative 4, the minimum cost is $646,664.

[3]Sites do not contain transuranic constituents waste like their representative site 216-B-7A Crib. Therefore, the costs are a ratio of the 216-B-57 Crib representative site.

[4]Costs for 241-B-361 Settling Tank were developed separately. The costs are not a ratio of the 216-B-7A Crib representative site.

[5]Cost is equal to cost for the 216-B-5 Injection/Reverse Well.

[6]Costs are equal to the 241-B-361 Settling Tank.

[7]The barrier developed for Alternatives 4 and 5 was the modified RCRA C barrier to cost sites analogous to this site. Currently, 216-B-57 is the site for the Hanford Barrier.

[8]Site may contain transuranic constituents above levels of concern that may need to be disposed of at the Waste Isolation Pilot Plant. Therefore, cost is a ratio of the disposal cost for TRU waste 216-B-7A Crib.

NA = not applicable.
Cost details are in Appendix D of the feasibility study.
Net present worth is taken over the timeframe needed to reach industrial and ecological preliminary remediation goals.

The net present worth for the analogous sites was calculated from the representative site net present worth based on either the area or the volume of the site. This was done using either the area ratio to representative site (Alternatives 2 and 4), the volume ratio to representative site (Alternative 3), or an average of the area and volume ratio to representative site. An explanation of area and volume ratios and their values can be found in Table D-103 in Appendix D of the feasibility study (DOE/RL-2003-64). Alternative 5 area and volume ratios, along with the average ratio, can be found in Table D-104. Both tables are located in Appendix D of the feasibility study. For example:

Representative Site 216-B-46 Crib
Alternative 2 = $1,728,295
Alternative 3 = $45,479,911
Alternative 4 = $5,547,617
Alternative 5 = $21,792,675

Analogous to the 216-B-46 Crib is the group of sites consisting of 216-B-14, 216-B-15, 216-B-16, 216-B-17, 216-B-18, and 216-B-19 Cribs, whose costs are calculated as follows:

Area Ratio (Table D-103) = 1.467
Volume Ratio (Table D-103) = 2.290
Average Ratio for Alternative 5 (Table D-104) = 1.619

Table A-1. Net Present Worth Cost Estimates (in $1,000). (4 Pages)

WASTE SITE/GROUP	ALTERNATIVE 1: No Action	ALTERNATIVE 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALTERNATIVE 3: Removal, Treatment, and Disposal	ALTERNATIVE 4: Capping	ALTERNATIVE 5: Partial Removal, Treatment, and Disposal with Capping

Alternative 2 = $1,728,295 x 1.467 = $2,535,409
Alternative 3 = $45,479,911 x 2.290 = $104,148,996
Alternative 4 = $5,547,617 x 1.467 = $8,138,354
Alternative 5 = $21,792,675 x 1.619 = $35,282,341

APPENDIX B

200-TW-1, 200-TW-2, AND 200-PW-5 OPERABLE UNIT WASTE SITE DETAILS

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Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
Representative Site			
216-T-26	The 216-T-26 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 5.5 m (18 ft). This crib was stabilized along with the 216-T-27 and 216-T-28 Cribs. Located approximately 99 m (325 ft) from the TY Tank Farm tanks and associated with the 216-T-26 through 216-T-28 Cribs. This crib is also approximately 46 m (150 ft) from the 216-T-18 Crib.	<u>Scavenged TBP Waste Stream</u> Tank Farm/T Plant (bismuth phosphate/lanthanum fluoride): 1955-1956 (~1 yr duration). The crib received first-cycle scavenged supernatant waste from 221-T via an underground pipeline and the 216-TY-201 Flush Tank after cascading through Tanks 241-TY-101, 241-TY-103, and 241-TY-104. It also received scavenged $BiPO_4$ solvent extraction waste from "In Plant" and "In Tank Farm" scavenging operations.	Investigated in 2001 under DOE/RL-2000-38; Characterization is described in the 200-TW-1 and 200-TW-2 RI Report (DOE/RL-2002-42). <u>Contaminant Distribution</u> Most of the contamination is located at the crib bottom in a zone from 18 ft to 36.5 ft (5.5 to 11 m) bgs. The predominant contaminant of is Cs-137. The lower portion of this zone is the approximate top of the Cold Creek Unit. Only Tc-99 and H-3 were detected greater than 28.8 m (94.5 ft) bgs, but concentrations were less than 4 pCi/g for these constituents in this zone. Maximum Cs-137 concentration occurred at the site bottom and generally decreased with depth to 11 m (36.5 ft); however, the maximum concentrations of most contaminants occurred in the lower portion of this contaminated zone 34 to 36.5 ft (10.4 to 11 m) bgs. Maximum Cs-137 concentration: 47,900 pCi/g; maximum Sr-90 Concentration: 49,100 pCi/g. Significant reduction in the levels of contamination is associated with top of the sand-dominated sequence of the Hanford formation and the Cold Creek Unit. RLS detected Cs-137 from near the surface to a depth of 128 ft (39 m) bgs. Log data indicate that most of the Cs-137 was detected from 18 to 91 ft (5.5 to 27.7 m) bgs and is distributed deeper in the vadose zone toward the south end of the site. The maximum concentration detected by RLS is estimated to be greater than 3,000 pCi/g. Because contamination starts below 4.6 m (15 ft) bgs, human health risks from direct exposure and ecological risks are not anticipated. However, significant contamination exists just below the bottom of the crib that could pose risk to intruders. In addition, contaminations located deeper in the vadose zone pose a potential threat to groundwater (i.e., these contaminants could migrate through the vadose under existing conditions and cause further or continued impacts to groundwater). Risks associated with this site imply that groundwater protection is required and that alternatives should consider protection against inadvertent intruders.
200-TW-1 OU analogous wastes sites to be evaluated by the (216-T-26 Crib) model			
216-T-18	The 216-T-18 Crib has the same construction as the 216-T-26 Crib, consisting of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 107 m (350 ft) from the TY Tank Farm tanks and approximately 46 m (150 ft) from the 216-T-26 Crib.	<u>Scavenging Test Effluent</u> T Plant: 1953. The site received first cycle scavenged test effluent from T Plant and scavenged bismuth phosphate solvent extraction waste from the URP process in the 221-U Building.	The 216-T-18 Crib is analogous to the 216-T-26 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-T-26 Crib; the contaminant types are expected to be very similar 2. Site construction is identical to 216-T-26 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 West; the geology of the two sites is similar 5. Based on geophysical logs for the borehole near the 216-T-18 Crib, the vertical extent of contamination is similar 6. Risks are expected to be similar to 216-T-26 Crib; because the top of the contamination is located at 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-T-26 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-T-26 Crib. More volume of effluent was

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			sent to the 216-T-26 Crib; however, modeling for the 216-T-26 Crib indicates that contaminants remaining in the vadose will likely impact groundwater. Because less volume was discharged to the 216-T-18 Crib, higher inventories could remain in the vadose (i.e., less contamination may have flushed to the water table), posing a more significant future threat to groundwater than from the 216-T-26 Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-T-26 Crib 8. Generally received less contaminant inventory than 216-T-26 Crib with the exception of plutonium; the amount of plutonium and the total volume discharged to a small site might have resulted in contaminant concentrations of transuranic constituents at levels of concern (i.e., greater than 100 nCi/g). In general, the 216-T-18 Crib is analogous to and bounded by the 216-T-26 Crib. Remedial actions are needed to address the same risks as those of the 216-T-26 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and plutonium).
Representative Site			
216-B-46	The 216-B-46 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 5.5 m (18 ft). Located approximately 140 m (460 ft) from the BY Tank Farm tanks and within the assembly of 216-B-43 through 216-B-50 Cribs.	<u>Scavenged TBP Waste Stream</u> Tank Farm/U Plant: 1955. The site received scavenged URP supernatant waste from the 221-U Building over a four-month period in 1955. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib. The waste was originally bismuth phosphate/lanthanum fluoride metal wastes from 221-B.	Investigated in 1991 as part of the 200-BP-1 OU under DOE/RL-88-32; characterization is described in the 200-BP-1 RI Report (DOE/RL-92-70). <u>Contaminant Distribution</u> Sample data confirm that the bottom of the waste site is about 5.5 m (18 ft) bgs. Maximum contaminant concentrations were detected near the bottom of the crib at a depth of 5.5 m (18 ft) and generally decreased with depth. Most of the contamination detected was within a zone extending from the bottom of the crib to 49 ft. Maximum Cs-137: 280,000 pCi/g; maximum Sr-90: 260,000 pCi/g (concentrations decayed to 01/01/2004). With exception of Tc-99 and nitrate, little contamination was detected greater than 14.9 m (49.0 ft). Technetium-99 concentration is 160 pCi/g at depths greater than 14.9 m (49 ft). Because contamination starts below 4.6 m (15 ft) bgs, human health risks from direct exposure and ecological risks are not anticipated. However, significant contamination exists just below the bottom of the crib that could pose risk to intruders. In addition, contamination located deeper in the vadose zone poses a potential threat to groundwater. Risks associated with this site imply that groundwater protection is required and that alternatives should consider protection against inadvertent intruders.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
200-TW-1 OU analogous wastes sites to be evaluated by the (216-B-46 Crib) model			
216-B-14	The 216-B-14 Crib is constructed of wood, cinder block and steel on a bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft). The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depth to the top of contamination is 3 m (10 ft).	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib. The point of the contaminant release is about 5 to 8 ft above the release point at the 216-B-46 Crib.	The 216-B-14 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-14 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar, based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site, as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. A slightly greater relative volume of effluent was sent to the 216-B-14 Crib; however, the larger size of the 216-B-14 Crib suggests that contaminants remaining in the vadose may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. Because less volume was discharged to the 216-B-14 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-46 Crib. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or slightly more contaminant inventory than 216-B-46 Crib with the exception of nitrate; this strengthens the need for groundwater protection at this waste site. In general, the 216-B-14 Crib is analogous and roughly equivalent to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-14 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-15	The 216-B-15 Crib is a 3.0 x 3.0 x 0.9 m high (10 x 10 x 3 ft) structure constructed of wood, cinder block, and steel on a bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft). The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956-1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib.	The 216-B-15 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-15 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4 m (13 ft) bgs, human health and ecological

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	the assembly of 216-B-14 through 216-B-19 Cribs.		risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. An equivalent volume of effluent was sent to the 216-B-15 Crib; however, the larger size of the 216-B-15 Crib suggests that contaminants remaining in the vadose may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. Because less volume was discharged to the 216-B-15 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-46 Crib. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib. 8. Generally received equivalent or less contaminant inventory than 216-B-46 Crib. In general, the 216-B-15 Crib is analogous and roughly equivalent to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-15 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-16	The 216-B-16 Crib is a 3.0 x 3.0 x 0.9 m high (10 x 10 x 3 ft) structure constructed of wood, cinder block, and steel on a 1.5 m (5 ft) bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft).The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depth to the top of contamination is 3 m (10 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-14 through 216-B-19 Cribs.	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib. The 216-B-16 Crib received scavenged waste over a short period of time (5 months).	The 216-B-16 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-16 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. A slightly lower volume of effluent was sent to the 216-B-16 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. Because less volume was discharged to the 216-B-16 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-46 Crib. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib. 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-16 Crib received higher inventories of uranium, and Cs-137, supporting the need for groundwater protection and the possibility of even higher shallow zone and intruder risks than the 216-B-46 Crib. In general, the 216-B-16 Crib is analogous to the 216-B-46 Crib, with

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			potential for higher risk from the Cs-137 in the shallow zone and in the zone at the bottom of the crib structure. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-16 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-17	The 216-B-17 Crib is a 3.0 x 3.0 x 0.9 m high (10 x 10 x 3 ft) structure constructed of wood, cinder block, and steel on a 1.5 m (5 ft) bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft). The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depth to the top of contamination is 3.4 m (11 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-14 through 216-B-19 Cribs.	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: 1956. The site received in-tank scavenged (first cycle) and scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib. The 216-B-17 Crib received waste over a short period of time (one month)	The 216-B-17 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-17 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.4 m (11 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. A lower volume of effluent was sent to the 216-B-17 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. Because less volume was discharged to the 216-B-17 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-46 Crib. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-17 Crib received a higher inventory of uranium, supporting the need for groundwater protection. In general, the 216-B-17 Crib is analogous and roughly equivalent to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-17 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-18	The 216-B-18 Crib is a 3.0 x 3.0 x 0.9 m high (10 x 10 x 3 ft) structure constructed of wood, cinder block, and steel on a 1.5 m (5 ft) bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft).The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depthto the top of contamination is 3.4 m (11 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-14 through 216-B-19 Cribs.	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: over a short period of time (one month) in 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib.	The 216-B-18 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-18 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; however, because the top of the contamination is about 3.4 m (11 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. A slightly greater volume of effluent was sent to the 216-B-18 Crib; however, the larger size of the 216-B-18 Crib suggests that contaminants remaining in the vadose may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. Because less relative volume was discharged to the 216-B-18 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-46 Crib. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib. 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-18 Crib received higher inventories of uranium and ferrocyanide, supporting the need for groundwater protection. In general, the 216-B-18 Crib is analogous and roughly equivalent to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-18 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-19	The 216-B-19 Crib is a 3.0 x 3.0 x 0.9 m high (10 x 10 x 3 ft) structure constructed of wood, cinder block, and steel on a 1.5 m (5 ft) bed of gravel. Bottom dimensions of the crib are 6.1 x 6.1 m (20 x 20 ft).The waste site dimensions are 24 x 24 x 4 m deep (80 x 80 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-14	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: 1957. The site received in-tank scavenged (first cycle) and scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the crib.	The 216-B-19 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib; however, the 216-B-19 Crib is slightly larger than the 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	through 216-B-19 Cribs.		may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. An equivalent volume of effluent was sent to the 216-B-19 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent contaminant inventory compared to 216-B-46 Crib. The 216-B-19 Crib received higher inventories of Cs-137 and a similar quantity of nitrate, supporting the need for groundwater protection and the possibility of even higher shallow zone and intruder risks than the 216-B-46 Crib. In general, the 216-B-19 Crib is analogous to the 216-B-46 Crib, with a potential for higher risk from the Cs-137 in the shallow zone and in the zone at the bottom of the crib structure. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-19 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-20	The 216-B-20 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 4 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-20 through 216-B-22 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-20 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-20 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-20 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or greater contaminant inventory than 216-B-46. The 216-B-20 Trench received higher inventories of Cs-137, and Tc-99 and uranium, supporting the need for groundwater protection and higher shallow zone and intruder risks than the 216-B-46 Crib.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			In general, the 216-B-20 Trench is analogous to the 216-B-46 Crib, with a potential for higher risk from the Cs-137 in the shallow zone and in the zone at the bottom of the trench structure, and higher risk from Tc-99 and uranium in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-20 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-21	The 216-B-21 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 4 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-20 through 216-B-22 Trenches.	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-21 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-21 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-21 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-21 Trench received higher inventories of uranium and Cs-137, supporting the need for groundwater protection and higher shallow zone and intruder risks than the 216-B-46 Crib. In general, the 216-B-21 Trench is analogous to the 216-B-46 Crib, with a potential for higher risk from the Cs-137 in the shallow zone and in the zone at the bottom of the trench structure, and higher risk from uranium in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-21 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-22	The 216-B-22 Trench is a backfilled unlined ditch. Waste site dimensions are	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX,	The 216-B-22 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	153 x 3 x 4 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-20 through 216-B-22 Trenches.	BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-22 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-22 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received less contaminant inventory than 216-B-46. The 216-B-22 Trench received higher inventory of uranium, supporting the need for groundwater protection. In general, the 216-B-22 Trench is analogous to the 216-B-46 Crib, with a potential higher risk from uranium in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-22 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-23	The 216-B-23 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 5.4 m deep (500 x 10 x 18 ft deep). Includes 2.4 m (8 ft) of overburden. The depth to the top of contamination is 5.8 m (19 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-23 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-23 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 5.8 m (19 ft) bgs, human health and ecological risks are not anticipated in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-23 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or less contaminant inventory than 216-B-46 Crib. Even so, the need for groundwater protection and the possibility of shallow zone and intruder risks exists. In general, the 216-B-23 Trench is analogous to the 216-B-46 Crib, with a potential for reduced risk in the shallow zone and in the zone at the bottom of the trench structure, and reduced risk in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-24	The 216-B-24 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 5.4 m deep (500 x 10 x 18 ft deep). Includes 2.4 m (8 ft) of overburden. The depth to the top of contamination is 5.8 m (19 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-24 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-24 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 5.8 m (19 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-24 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or less contaminant inventory than 216-B-46 Crib, except for uranium and roughly four times the quantity of plutonium. The need for groundwater protection and the possibility of shallow zone and intruder risks exists. In general, the 216-B-24 Trench is analogous to the 216-B-46 Crib, with a potential for reduced risk in the shallow zone and in the zone at the bottom of the trench structure, and reduced risk in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-25	The 216-B-25 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 6.2 m deep (500 x 10 x 20 ft deep). Includes 3 m (10 ft) of overburden. The depth to the top of contamination is 5.8 m (19 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-25 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-25 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 5.8 m (19 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Roughly half the relative volume of effluent was sent to the 216-B-25 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received less contaminant inventory than 216-B-46 Crib. In general, the 216-B-25 Trench is analogous to the 216-B-46 Crib, with a potential for reduced risk in the shallow zone and in the zone at the bottom of the trench structure, and reduced risk in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-26	The 216-B-26 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 5.4 m deep (500 x 10 x 18 ft deep). Includes 2.4 m (8 ft) of overburden. The depth to the top of contamination is 5.8 m (19 ft). However, RLS logging of the C4191 borehole through the trench indicated contamination at approximately 3.7 m (12 ft) bgs. Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1956-1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-26 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-26 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (216-B-43 – 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-26 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-26 Trench received higher inventories of uranium and Cs-137 supporting the need for groundwater protection. The 216-B-26 Trench was sampled in 2003 and is reported in this document. Contaminant Distribution is as follows, Sample data revealed that the bottom of the waste site is near 4.5 m (13 ft) bgs. The bulk of the contamination was observed at this depth. Maximum Cs-137: 529,00 pCi/g at 4.0 – 4.7 m (13 – 15.5 ft) bgs. Maximum Sr-90: 974,000 pCi/g at the same depth. Maximum plutonium-239/240: 195 pCi/g at the same depth. Maximum total uranium: 56.9 mg/kg at the same depth. Technetium-99 and nitrate were observed deeper in the vadose zone. Maximum Tc-99: 92 pCi/g at about 30.5 m (100 ft) bgs. Maximum nitrate: 4,090 mg/kg at the same depth. Because contamination starts above 4.6 m (15 ft) bgs, human health risks from direct exposure risks are anticipated. Significant contamination exists just below the bottom of the trench that could pose risk to intruders. In addition, contamination located deeper in the vadose zone poses a potential threat to groundwater. Risks associated with this site imply that groundwater protection is required and that alternatives should consider protection against inadvertent intruders.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-27	The 216-B-27 Trench is a backfilled unlined ditch. Waste site dimensions are 153 3 x 5.4 m deep (500 x 10 x 18 ft deep). Includes 2.4 m (8 ft) of overburden. The depth to the top of contamination is 5.5 m (18 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-27 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-27 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 5.5 m (18 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. About half the relative volume of effluent was sent to the 216-B-27 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or lesser contaminant inventory than 216-B-46 Crib. The 216-B-27 Trench received a higher inventory of uranium, though, supporting the need for groundwater protection. In general, the 216-B-27 Trench is analogous to the 216-B-46 Crib, with a potential higher risk from uranium in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-28	The 216-B-28 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 10 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-28 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-28 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-28 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or lesser contaminant inventory than 216-B-46 Crib. Even so, the need for groundwater protection exists. In general, the 216-B-28 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-28 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-29	The 216-B-29 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-29 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-29 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-29 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or lesser contaminant inventory than 216-B-46 Crib. The 216-B-29 Trench received a higher inventory of uranium, supporting the need for groundwater protection. In general, the 216-B-29 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			shallower at the 216-B-29 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-30	The 216-B-30 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	<u>Scavenged TBP Waste Stream</u> Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-30 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-30 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-30 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received lesser contaminant inventory than 216-B-46 Crib. The 216-B-30 Trench received considerably higher inventories of Cs-137, supporting the need for intruder protection. In general, the 216-B-30 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-30 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-31	The 216-B-31 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-31 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-31 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-31 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received lesser contaminant inventory than 216-B-46 Crib. In general, the 216-B-31 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-31 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-32	The 216-B-32 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-32 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-32 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-32 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received lesser contaminant inventory than 216-B-46 Crib. In general, the 216-B-32 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-32 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-33	The 216-B-33 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-33 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-33 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. About half the relative volume of effluent was sent to the 216-B-33 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received lesser contaminant inventory of mobile constituents than 216-B-46 Crib; also received a higher inventory of Cs-137, which would imply a greater risk to humans from direct exposure, to ecological receptors, and to intruders. In general, the 216-B-33 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			shallower at the 216-B-33 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-34	The 216-B-34 Trench is a backfilled unlined ditch. Waste site dimensions are 153 x 3 x 3 m deep (500 x 10 x 13 ft deep). The depth to the top of contamination is 4 m (13 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-28 through 216-B-34 Trenches.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1957. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-34 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-34 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly more than half the relative volume of effluent was sent to the 216-B-34 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received lesser contaminant inventory than 216-B-46 Crib. The 216-B-34 Trench received a higher inventory of nitrate, supporting the need for groundwater protection. In general, the 216-B-34 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-34 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-42	The 216-B-42 Trench is a backfilled unlined ditch. Waste site dimensions are 77 x 3 x 3 m deep (252 x 10 x 13 ft deep). The depth to the top of contamination is 3 m (10 ft). Located approximately 167 m (550 ft) from the BX Tank Farm tanks and associated with the assembly of 216-B-35 through 216-B-42 Cribs.	Scavenged TBP Waste Stream Tank Farm/B, BX, BY: 1955. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-42 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-42 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs)

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			6. Risks are expected to be similar to 216-B-46 Crib; because the top of the contamination is about 3.0 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. About half the relative volume of effluent was sent to the 216-B-42 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received a lesser contaminant inventory than 216-B-46 Crib. The 216-B-42 Trench received a higher inventory of uranium, supporting the need for groundwater protection. In general, the 216-B-42 Trench is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, *specifically protection of groundwater and protection against intrusion* to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-42 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-43	The 216-B-43 Crib consists of four 1.2 m (4 ft) diameter x 1.2 m (4 ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart. Construction data indicate that the crib is in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. Sample data collected in 1993 confirm *that the bottom of the* excavation after stabilization (i.e., addition of 3 ft of clean soil) is about 5.4 m (18 ft). Located approximately 61 m (200 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	Scavenged TBP Waste Stream The 216-B-43 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. Cribs B-43 to B-50 were stabilized together in 1975 with 0.3 m (1 ft) clean soil. *Contaminated* soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991.	The 216-B-43 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. *Site construction is the same as 216-B-46 Crib* 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. *The vertical extent of contamination is similar based on characterization* evidence from this site; contaminants were found mainly in a zone from 5.6 to 9.8 m (18.5 to 32 ft) bgs (this was a shallow borehole; based on 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 Cribs series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about *5.4 m (18 ft)* bgs, *direct contact human health* risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. About one-third the relative volume of effluent was sent to the 216-B-43 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or less contaminant inventory than 216-B-46 Crib, except for more Cs-137 and cyanide, supporting the need for

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			intruder and groundwater protection. In general, the 216-B-43 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-44	The 216-B-44 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 5.5 m (18 ft). Sample data collected in 1993 confirm that the bottom of the excavation after stabilization (i.e., addition of 3 ft of clean soil) is about 18 ft. Located approximately 91 m (300 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	Scavenged TBP Waste Stream The 216-B-44 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. The 216-B-43 to 216-B-50 Cribs were stabilized together in 1975 with 0.3 m (1 ft) clean soil. Contaminated soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991.	The 216-B-44 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is the same as 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 5.8 to 9.6 m (19 to 31.5 ft) bgs (this was a shallow borehole; based on 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 Cribs series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about 5.4 m (18 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly less relative volume of effluent was sent to the 216-B-44 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-44 Crib received considerably higher inventories Cs-137 and Sr-90, supporting the need for intruder protection. In general, the 216-B-44 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-45	The 216-B-45 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. A light chain outlines the group of cribs. The estimated depth to the	Scavenged TBP Waste Stream The 216-B-45 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. The 216-B-43 to 216-B-50 Cribs were stabilized together in 1975 with	The 216-B-45 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is the same as 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	top of contamination is 5.2 m (17 ft). Located approximately 114 m (375 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	0.3 m (1 ft) clean soil. Contaminated soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991.	5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 5.2 to 9 m (17 to 29.5 ft) bgs (this was a shallow borehole; based on 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 Cribs series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about 5.2 m (17 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly less relative volume of effluent was sent to the 216-B-45 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received less contaminant inventory than 216-B-46 Crib except for considerably higher inventories of Cs-137 and Sr-90, supporting the need for intruder protection. In general, the 216-B-45 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-47	The 216-B-47 Crib has four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. Estimated depthto the top of contamination is 6.4 m (21 ft). Located approximately 61 m (200 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	<u>Scavenged TBP Waste Stream</u> The 216-B-47 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. The 216-B-43 to 216-B-50 Cribs were stabilized together in 1975 with 0.3 m (1 ft) clean soil. Contaminated soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991. A light chain outlines the group of cribs.	The 216-B-47 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is the same as 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 6.4 to 10.7 m (21 to 35 ft) bgs (this was a shallow borehole; based on 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 Cribs series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about 6.4 m (21 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly less relative volume of effluent was sent to the 216-B-47 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			8. Generally received less contaminant inventory than 216-B-46 Crib. In general, the 216-B-47 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-48	The 216-B-48 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 5.3 m (17.5 ft). Located approximately 91 m (300 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	Scavenged TBP Waste Stream The 216-B-48 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. The 216-B-43 to 216-B-50 Cribs were stabilized together in 1975 with 0.3 m (1 ft) clean soil. Contaminated soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991. A light chain outlines the group of cribs.	The 216-B-48 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is the same as 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 5.2 to 9.8 m (17 to 32 ft) bgs (this was a shallow borehole; based on 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 Cribs series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about 5.3 m (17.5 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Approximately half the relative volume of effluent was sent to the 216-B-48 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received less contaminant inventory than 216-B-46 Crib. The 216-B-48 Crib received higher inventories of Tc-99 and Cs-137, supporting the need for intruder protection. In general, the 216-B-48 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-49	The 216-B-49 Crib consists of four 1.2 m (4-ft)-diameter x 1.2 m (4-ft) long concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 x 9.1 x 4.6 m deep (30- x 30- x 15-ft deep) excavation. The depth to the top of contamination is 5 m (16.5 ft). Located approximately 114 m (375 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	<u>Scavenged TBP Waste Stream</u> The 216-B-49 Crib received URP/ scavenged liquid extraction waste routed via BY Tank Farm. The 216-B-43 to 216-B-50 Cribs were stabilized together in 1975 with 0.3 m (1 ft) clean soil. Contaminated soil from UPR-200-E-89 was consolidated onto the 216-B-43 to 216-B-50 Cribs and covered with 0.6 m (2 ft) of clean fill in 1991. A light chain outlines the group of cribs.	The 216-B-49 Crib is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this FS: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 5 to 14.9 m (16.5 to 49 ft) bgs (this was drilled to the water table; Tc-99 and nitrate were found throughout the vadose zone) 6. Risks are similar to 216-B-46 Crib; because the top of the contamination is about 5 m (16.5 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. Mobile contaminants, such as nitrate and Tc-99, were found throughout the vadose zone, suggesting the need for groundwater protection 8. Generally received equivalent or greater contaminant inventory than 216-B-46 Crib. The 216-B-49 Crib received higher inventories of uranium, Cs-137, Sr-90 and nitrate, supporting the need for intruder and groundwater protection. In general, the 216-B-49 Crib is analogous to the 216-B-46 Crib. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).
216-B-51	The 216-B-51 French Drain is a 1.5 m (5-ft) diameter concrete pipe extending 0.3 m (1 ft) above ground and 4.3 m (14 ft) below ground. The pipe is filled with 4 m (13 ft) of gravel. The depth to the top of contamination is 4.0 m (13 ft) (estimated). It is an isolated waste site that is more than 213 m (700 ft) from the BY Tank Farm tanks.	<u>Scavenged TBP Waste Stream</u> Tank Farm/BY: 1956-1958. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the french drain. Very little data are available to evaluate this site.	The 216-B-51 French Drain is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib although it is a French drain rather than a crib 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar (or less) based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to but less than for the 216-B-46 Crib; because the top of the contamination is about 4.9 m (16 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this waste site suggests that contaminant inventory in the vadose zone does not pose a threat to groundwater. Much less relative volume of effluent was sent to the 216-B-51 French Drain. 8. Very little contaminant inventory data are available; however, it is believed that the 216-B-51 French Drain received substantially lesser contaminant inventory than 216-B-46 Crib. In general, the 216-B-51 French Drain is bounded by the 216-B-46 Crib. Remedial actions are expect to be less than those for the 216-B-46 Crib. It

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			should not be necessary to provide groundwater protection and protection against intrusion. Contaminant concentrations are expected to be low and decay to PRG within 150 yr.
216-B-52	The 216-B-52 Trench is a backfilled unlined ditch. Waste site dimensions are 177 x 3 x 3 m deep (580 x 10 x 10 ft deep). The depth to the top of contamination is 3.7 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-23 through 216-B-28 and 216-B-52 Trenches.	In-Tank Scavenged Waste Stream Tank Farm/B, BX, BY: 1957-1958. The site received scavenged bismuth phosphate waste from URP process waste in the 221-U Building. The waste cascaded through the BY Tank Farm tanks before being discharged to the trench.	The 216-B-52 Trench is analogous to the 216-B-46 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-46 Crib despite 216-B-52 being a trench rather than a crib; both are unlined near-surface liquid disposal sites 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to 216-B-46 Crib; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-46 Crib 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-46 Crib. Slightly less relative volume of effluent was sent to the 216-B-52 Trench; this suggests that contaminants remaining in the vadose may not have been flushed through the trench and concentrations may exceed those found in 216-B-46 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at 216-B-46 Crib 8. Generally received greater contaminant inventory than 216-B-46 Crib. The 216-B-52 Trench received higher inventories of Cs-137, Tc-99, nitrate and cyanide, supporting the need for groundwater protection and the possibility of even higher shallow zone and intruder risks than the 216-B-46 Crib. In general, the 216-B-52 Trench is analogous to the 216-B-46 Crib, with a potential for higher risk from the Cs-137 in the shallow zone and in the zone at the bottom of the trench structure, and higher risk from Tc-99, cyanide and nitrate in the deeper vadose soil. Remedial actions are needed to address the same risks as those of 216-B-46 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-52 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-BY-201	The 216-BY-201 Settling Tank is a rectangular, reinforced concrete tank. The tank dimensions are 12.5 x 1.9 x 4.3 m (41 x 6 x 14 ft). 1.5 m (5 ft) is overburden. The depth to the top of contamination over the top of the tank is 1.5 m (5 ft). Located approximately 46 m (150 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	In-Tank Scavenged Waste Stream Tank Farm/BY: 1954-1958. The tank received tank farm and scavenged bismuth phosphate solvent extraction waste from the URP process waste in the 221-U Building.	The 216-BY-201 Settling Tank is analogous to the 216-B-46 Crib as indicated by waste stream chemistry and the expected distribution of contamination. Radioactive waste from the BY Tank Farm overflowed to this tank enroute to the 216-B-43 to 216-B-50 Cribs. The tank was designed to scavenge the TBP waste. Relatively free of solids, a small amount of salt cake may have been deposited in the tank. The volume of material in the tank is unknown but is less than 2800 L (750 gal) of sludge based on the low-liquid level where flushing action of the tank would stop and 31,100 L (8,230 gal) of liquid based on the high-liquid level where tank flushing action would commence: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be the same 2. Site construction is not similar to 216-B-46 Crib in that it was not designed as an unlined near-surface liquid disposal site; instead it was intended to be a process vessel 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less because there is no evidence that the tank has leaked 6. Risks are expected to be much less than for 216-B-46 Crib because less contamination is expected to be associated with the tank; sludge in the tank bottom is expected to be the main source of risk for the site; the contamination associated with the sludge is less than 5.8 m (19 ft) bgs, and human health and ecological risks may be associated with the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination in the tank sludge 7. Groundwater threat is not expected for this tank, particularly any leak from this tank, because the tank was designed to pass effluents to the cribs and not to allow infiltration to the soil column; a leak associated with UPR-200-E-9 was cleaned up at the time of release; historical evidence of other leaks has not been documented. In general, the 216-BY-201 Settling Tank is analogous to the 216-B-46 Crib. Remedial actions are needed to address some of the same risks the 216-B-46 Crib, specifically protection against intrusion to contaminants in the bottom of the tank which could pose a significant direct contact risk to a potential intruder. The tank is located in proximity to the 216-B-43 through 216-B-50 series of cribs.
UPR-200-E-9	The exact size of the release has not been determined. The general area and size of the release is depicted in HW-60807. The depth to the top of contamination is 3 m (10 ft). Located in the assembly of 216-B-43 through 216-B-50 Cribs just south of the 216-B-43 Crib.	Scavenged TBP Waste Stream Tank Farm/BY: 1955. UPR-200-E-9 is associated with the 216-BY-201 Settling Tank. The release consisted of scavenged bismuth phosphate solvent extraction waste from the URP process waste from the 221-U Building.	The UPR-200-E-9 unplanned release is analogous to the 216-B-46 Crib as indicated by the waste stream received. Approximately 41,800 L of scavenged waste overflowed from the 216-BY-201Settling Tank and was released to the ground; most of the waste was cleaned up and removed from the site: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to 216-B-46 Crib in that it was a spill rather than a near-surface liquid disposal site 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less because the quantity of the spill was much less 6. Risks are expected to be much less than for 216-B-46 Crib; because the depthto the top of contamination is 3.0 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; however, these are expected to be low because the majority of the contaminants

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			have been removed 7. The effluent volume spilled and the clean up activities conducted after the spill suggest that contaminant inventory in the vadose zone probably does not pose a threat to groundwater 8. Generally received lesser contaminant inventory than 216-B-46 Crib. In general, the UPR-200-E-9 unplanned release is bounded by the 216-B-46 Crib, with a potential for low risk to human and ecological receptors from near-surface contamination.
200-E-114	The 216-E-114 Pipeline is a steel pipeline. The pipeline extends from the BY and C Tank Farms to the BC Cribs and Trench Area. The pipeline is approximately 4,600 m (15,100 ft) long with a diameter of 6 cm (2.4 in.). The depth to the pipe is assumed to be 2.1 to 3.0 m (7 to 10 ft).	Scavenged TBP Waste Stream Tank Farm/BY and C: 1952-1954. The pipeline transported scavenged bismuth phosphate solvent extraction waste from the URP process waste in the 221-U Building.	The 200-E-114 Pipeline is analogous to the 216-B-46 Crib: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to 216-B-46 Crib in that it was not designed as an unlined near-surface liquid disposal site; instead it was intended to be a transfer pipeline 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less, because there is evidence that only minor pipeline leakage has occurred. In 1997, contamination measuring 2,500 to 5,000 dpm beta/gamma was observed in a 6.1 x 30.5 m (20 x 100 ft) area straddling the pipeline northeast of the B Tank Farm near the point where it turns south. In 2001, another radiological survey found contamination measuring up to 19,000 dpm beta/gamma within a 15.2 m (50 ft) diameter area straddling the pipeline near its junction to the 216-B-51 French Drain 6. Risks are expected to be much less than for 216-B-46 Crib; because the pipeline depth varies from about 2.1 to 3.0 m (7 to 10 ft) bgs, human health and ecological risks may exist in the 0 to 4.6 m (0 to 15-ft) zone where leaks have occurred 7. Groundwater threat is not expected for this pipeline, because the pipeline was designed to pass effluents to the cribs and not to allow infiltration to the soil column; no historical evidence of leaks has been documented 8. Generally received lesser contaminant inventory than 216-B-46 Crib. In general, the 200-E-114 Pipeline is bounded by the 216-B-46 Crib, with a potential for low risk to human and ecological receptors from near-surface contamination.
216-E-14	The 216-E-14 Siphon Tank is an underground tank. Tank dimensions are 8.2 x 3.9 m (27 x 12.75 ft). The depth to the top of contamination is 2.1.m (7 ft) to the top of the tank; however, the tank vent is only 0.6 m (2 ft) below current ground level. Located in the BC Cribs and Trenches Area and within the assembly of 216-B-14 through 216-B-19 Cribs.	Scavenged TBP Waste Stream Tank Farm/BY: 1956-1958. The tank received tank farm and scavenged bismuth phosphate solvent extraction waste from the URP process waste in the 221-U Building. The tank discharged waste to the 216-B-14 through 216-B-19 Cribs	The 200-E-14 Siphon Tank is analogous to the 216-B-46 Crib waste site as indicated by waste stream chemistry and the expected distribution of contamination. Radioactive waste from the BY tank farm system was received by this tank for routing to the 216-B-14 to 216-B-19 Cribs. The volume of material in the tank is unknown but is less than 3,825 L (1,010 gal) of sludge based on the low-liquid level where flushing action of the tank would stop and 31,100 L (41,800 gal) of liquid based on the high-liquid level where tank flushing action would commence: 1. Received the same waste stream as 216-B-46 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to 216-B-46 Crib in that it was not designed as an unlined near-surface liquid disposal site; instead it was intended to be an accumulation tank that discharged to specific cribs when full 3. Waste was received from the same source (221-U) 4. Both sites are located in 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less, because there is no evidence that the tank has leaked

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			6. Risks are expected to be much less than for 216-B-46 Crib; because the top of potential sludge in the tank bottom is about 2.1 m (7 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the tank 7. Groundwater threat is not expected for this tank because the tank was designed to pass effluents to the cribs and not to allow infiltration to the soil column; no historical evidence of leaks has been documented 8. Generally received lesser contaminant inventory than 216-B-46 Crib. In general, the 200-E-14 Siphon Tank, particularly any leak from this tank, is bounded by the 216-B-46 Crib, with a potential for lower risk from the Cs-137 in the bottom of the tank. Remedial actions are needed to address direct contact risk to humans and ecological receptors; groundwater protection is not generally considered to be needed. Because the contamination is shallower at the 200-E-14 Siphon Tank, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
Representative Site			
216-B-58	The 216-B-58 Trench is 60 m (200 ft) long x 3.0 m (10 ft) wide and 3.0 m (10 ft) deep. It was divided into eight 8 m (25 ft) sections by earthen dams that were 1.5 m (5 ft) high and 0.1 m (0.3 ft) wide at their top. A corrugated 1.22 m (4 ft) diameter perforated pipe runs the length of the trench except for the western 8 m (25 ft) section. The depth to the top of contamination is 3.6 m (12 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-53A through 216-B-58 Trenches.	<u>300 Area Laboratory Waste</u> Liquid wastes from the 300 Area laboratory facilities were trucked to this trench from 1965 to 1967.	Investigated in 2003; characterization is described in this document. <u>Contaminant Distribution</u> Sampling confirms that the bottom of the waste site is about 4.1 m (13.5) bgs. The bulk of the contamination is in the 4.1 to 4.9 m (13.5 to 16 ft) bgs zone. The predominant contaminant is Cs-137. A maximum Cs-137 concentration of 14,600 pCi/g was detected at a depth of about 4.3 m (14 ft) bgs. At 8.1 m (26.5 ft) bgs, the concentration was 69.9 pCi/g. A maximum Pu-239/240 concentration of 310 pCi/g was detected at about 4.3 m (14 ft) bgs. Barium concentration peaks at about 7.3 m (24 ft) bgs (100 mg/kg). Selenium concentration peaks at about 5.8 m (19 ft) bgs (13 mg/kg). Because contamination begins at depths shallower than 4.6 m (15 ft) bgs, human health risks from direct exposure and ecological risks are anticipated. This contamination also presents a risk to potential intruders. Minor concentrations of mobile contaminants suggest that risk to groundwater may be minor.

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
200-TW-1 OU analogous wastes sites to be evaluated by the (216-B-58 Trench) model			
216-B-53A	The 216-B-53A Trench is 18.3 m (60 ft) long x 3.0 m (10 ft) wide and 3.0 m (10 ft) deep. It was divided into two sections by an earthen dam at the center that was 1.5 m (5 ft) high and 0.1 m (0.3 ft) wide at its top. The depth to the top of contamination is 3 m (10 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-53A through 216-B-58 Trenches.	PRTR Process Tube Failure Cleanup Waste Stream Trench received liquid waste associated with the PRTR reactor upset (process tube failure). Secondary cooling water became contaminated with plutonium and mixed fission products. Of all of the specific retention trenches in the BC Cribs and Trenches Area, only this trench has the potential to have concentrations of transuranic constituents above 100 nCi/g. Trench was active in October and November 1965.	The 216-B-53A Trench is analogous to the 216-B-58 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. It did not receive the same waste stream; rather, it received secondary cooling water from the PRTR reactor following a fuel cladding failure 2. Site construction is similar to the 216-B-58 Trench 3. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 4. The vertical extent of contamination is expected to be similar based on effluent volume received 5. Risks are expected to be similar to 216-B-58 Trench; because the top of the contamination is about 3.0 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-58 Trench 6. Although the relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may be deeper than at 216-B-58 Trench; the quantity of contaminants having potential to impact groundwater is relatively small, suggesting that the risk to groundwater may be negligible 7. Generally received equivalent or greater contaminant inventory than 216-B-58 Trench. The 216-B-53A Trench received higher inventories of uranium and plutonium, supporting the possibility of even higher shallow zone and intruder risks than the 216-B-58 Trench. In general, the 216-B-53A Trench is analogous to the 216-B-58 Trench, with a potential for higher risk from the plutonium in the shallow zone and in the zone at the bottom of the trench structure. Remedial actions are needed to address the same risks as those of the 216-B-58 Trench, specifically protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (plutonium).
216-B-53B	The 216-B-53B Trench is 46 m (150 ft) long x 3.0 m (10 ft) wide and 3.0 m (10 ft) deep. It was divided into two sections by an earthen dam at the center that was 1.5 m (5 ft) high and 0.1 m (0.3 ft) wide at its top. The depth to the top of contamination is 3 m (10 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-53A through 216-B-58 Trenches.	300 Area Laboratory Waste Liquid wastes from the 300 Area laboratory facilities were trucked to this trench from 1962 to 1963.	The 216-B-53B Trench is analogous to the 216-B-58 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-58 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-58 Trench 3. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 4. The vertical extent of contamination is expected to be similar based on effluent volume received 5. Risks are expected to be similar to 216-B-58 Trench; because the top of the contamination is about 3.1 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-58 Trench 6. The relative effluent volume discharged to this trench suggests that the contaminant inventory in the vadose zone should be very close to the bottom of the trench, similar to 216-B-58 Trench. Also, the quantity of contaminants having potential to impact groundwater is relatively small, suggesting that the risk to groundwater may be negligible 7. Generally received equivalent inventory compared to 216-B-58 Trench. In general, the 216-B-53B Trench is analogous to the 216-B-58 Trench, with a potential for risk from contamination in the shallow zone and in the zone at the bottom of the trench structure. Remedial actions are needed to address

Table B-1. 200-TW-1 Operable Unit Representative Sites and Associated Analogous Waste Sites. (29 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			the same risks as those of 216-B-58 Trench, specifically protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants.
216-B-54	The 216-B-54 Trench is 60 m (200 ft) long x 3.0 m (10 ft) wide and 3.0 m (10 ft) deep. It was divided into two sections by an earthen dam at the center that was 1.5 m (5 ft) high and 0.1 m (0.3 ft) wide at its top. The depth to the top of contamination is 2 m (7 ft). Located in the BC Cribs and Trenches Area and within the assembly of 216-B-53A through 216-B-58 Trenches.	<u>300 Area Laboratory Waste</u> Liquid wastes from the 300 Area laboratory facilities were trucked to this trench from March to October 1963.	The 216-B-54 Trench is analogous to the 216-B-58 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-58 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-58 Trench 3. Both sites are located in 200 East Area in proximity to each other; the geology of the two sites is similar 4. The vertical extent of contamination is expected to be similar based on effluent volume received 5. Risks are expected to be similar to 216-B-58 Trench; because the top of the contamination is about 2.0 m (7 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at 216-B-58 Trench 6. Somewhat more relative volume of effluent was sent to the 216-B-54 Trench, suggesting that contaminants in the vadose soil may be somewhat deeper than at 216-B-58 Trench. However, the quantity of contaminants having potential to impact groundwater is relatively small, suggesting that the risk to groundwater may be negligible 7. Generally received less or equivalent or greater contaminant inventory than 216-B-58 Trench. In general, the 216-B-54 Trench is analogous to the 216-B-58 Trench, with a potential for risk from contamination in the shallow zone and in the zone at the bottom of the trench structure. Remedial actions are needed to address the same risks as those of 216-B-58 Trench, specifically protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants.

* BHI-01496, *Groundwater/Vadose Zone Integration Project Hanford Soil Inventory Model.*
DOE/RL-88-32, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-1 Operable Unit, Hanford Site, Richland, Washington.*
DOE/RL-92-70, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit,* Vols. 1 and 2, Rev. 0.
DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations,* Rev. 0.
DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan.*
HNF-1744, *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site.*
HW-60807, *Unconfined Underground Radioactive Waste and Contamination in the 200 Areas - 1959.*
Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
OU = operable unit.
PRTR = Plutonium Recycle Test Reactor.
RI = remedial investigation.
RLS = radionuclide logging system.
TBP = tributyl phosphate.
TRU = contaminated with 100 nCi/g of transuranic materials with half-lives longer than 20 years.
UPR = unplanned release.
URP = Uranium Recovery Process.
WIDS = *Waste Information Data System Report.*

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
Representative Site			
216-B-5	The 216-B-5 Injection/Reverse Well extends to a depth of 92 m (302 ft). The 20 cm (8-in.) diameter borehole casing is perforated from 74 m to 92 m (243 to 302 ft). Contaminants were injected directly into the aquifer. The depth to the top of contamination is 74.1 m (243 ft). Isolated from significant structures except the 241-B-361 Settling Tank located approximately 18 m (60 ft) away.	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received the liquid waste from 221-B and 224-B via overflow of the 216-BY-201 Settling Tank. Liquid process effluent was received between 1945 and 1947 (2 years).	The 216-B-5 Injection Well/Reverse Well was characterized in 1980 (RHO-ST-37). Contamination in the vadose zone is about 73 to 86.6 m (243 to 284 ft) bgs at the 216-B-5 Injection Well/Reverse Well. Cesium-137, Sr-90, Pu-239/240 and Am-241 were the only constituents analyzed and detected. The maximum concentrations of Cs-137, Sr-90, Pu-239/240, and Am-241 range from 1,800 to 75,000 pCi/g. The Injection Well/Reverse Well received the same waste stream as the 216-B-7A Crib and 216-B-7B Cribs; therefore, similar contaminants should be present. Within the aquifer, contaminant concentration generally increases with depth.
200-TW-2 OU analogous wastes sites to be evaluated by the (216-B-5Injection Well/Reverse Well) model			
216-T-3	The 216-T-3 Injection/Reverse Well is a 20 cm (8-in.) diameter Injection Well/Reverse Well drilled to 62.8 m (206 ft) and perforated from 32.0 m (105 ft) to 62.2 m (204.1 ft). It consisted of well casings with varying diameters. The depth to the top of contamination is about 32 m (105 ft). Isolated from significant structures except the adjacent 241-T-361 Settling Tank and the 216-T-6 Crib, which are approximately 61 m (200 ft) away.	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received low salt, neutral/basic liquid waste from cell drainage from tank 5-6 in the 221-T canyon building and 224-T via the 241-T-361 Settling Tank. Site received liquid waste between June 1945 and August 1946 (active for 1 year).	The 216-T-3 Injection Well/Reverse Well is analogous to the 216-B-5 Injection Well/Reverse Well as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-5 Injection Well/Reverse Well; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-5 Injection Well/Reverse Well in that both are injection well/reverse wells 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on similar methods of operation 6. Risks are expected to be similar to the 216-B-5 Injection Well/Reverse Well; however, because the top of the contamination is about 32 m (105 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The effluent volume discharged to this waste site suggests that residual contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-5 Injection Well/Reverse Well. Although groundwater is already believed to be impacted, further impact is not anticipated from residual contaminants deep in the vadose soil due to the relatively immobile nature of the contaminants. 8. Generally received equivalent or less contaminant inventory than the 216-B-5Injection Well/Reverse Well; even so, groundwater protection is expected to be required. In general, the 216-T-3 Injection Well/Reverse Well is analogous to and bounded by the 216-B-5 Injection Well/Reverse Well. Remedial actions are needed to address the same risks as those of the 216-B-5 Injection Well/Reverse Well, specifically protection of groundwater.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
Representative Site			
216-B-7A and 216-B-7B Cribs	The 216-B-7A Crib is the representative site, and the 216-B-7B Crib is analogous to it. Each crib is a hollow (i.e., not gravel-filled) 3.7 x 3.7 x 1.2 m (12 x 12 x 4 ft) high wooden structure made of 15 x 15 cm (6 x 6 in.) timbers placed in a 4.2 x 4.2 x 4.2 m (14 x 14 x 14 ft) deep excavation. Associated with, and assumed to contain similar types and concentrations of contaminants to the 216-B-7A Crib is the 216-B-7B Crib, which is located to the northwest of the 216-B-7A Crib. The cribs are about 28 ft apart. The cribs are underneath a large area of contaminated soil from the UPR-200-E-144 stabilization. This soil was covered with clean backfill and posted with "Underground Radioactive Material" signs. The crib locations are marked with light posts and chain with "Cave-In" warning signs. The depth to the top of contamination is 5.5 m (18 ft).	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received liquid waste from 221-B and 224-B via overflow of the 216-BY-201 Settling Tank. Liquid process effluent was received at the cribs between 1946 and 1967 (active for 21 years).	The 216-B-7A Crib was characterized in 2001 (DOE/RL-2000-38). The results are presented in DOE/RL-2002-42. The crib received waste from the 221-B and 224-B Buildings via overflow of the 241-B-201 Settling Tank. The crib received significant inventories of Cs-137, plutonium, uranium, Sr-90, and nitrate; the effluent volume received was sufficient to impact groundwater. Soil data indicate that contamination is associated with the point of release about 5.5 m (18 ft) bgs and extends to a depth of about 11.4 m (37.5 ft) bgs. Very little contamination is present beyond a depth of 11.4 m (37.5 ft). RLS data indicate that contamination extends to a depth of about 85 ft near the crib. Maximum contaminant concentrations detected: Pu-239/240: 153,000 pCi/g; Cs-137: 153,000 pCi/g; Sr-90: 5,710,000 pCi/g; Tc-99: 37.9 pCi/g; and uranium: 346 ppm. The 216-B-7B Crib is included in the description for 216-B-7A Crib (and is analogous) because of identical construction and receipt of the same waste stream from the same feed piping; 216-B-7B acted as the overflow for 216-B-7A Crib.
200-TW-2 OU analogous wastes sites to be evaluated by the (216-B-7A Crib) model			
216-B-8	The 216-B-8 Crib is a 3.7 x 3.7 x 2.1 m (12 x 12 x 7 ft) high wooden structure constructed from 6 x 6 in. wooden timbers that were placed in a 4.2 x 4.2 x 6.9 m (14 x 14 x 22.5 ft) deep excavation. The crib has an associated tile field measuring 91.4 x 30.5 m (300 x 100 ft). Tile depth is associated with	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received second-cycle waste supernatant from 221-B Building. Sludge from the 241-B-104 Tank was inadvertently released to the crib and the crib became plugged. The sludge contained	The 216-B-8 Crib is analogous to the 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-7A Crib 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50)

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	the bottom of the crib excavation. The tile field is constructed in a chevron pattern having a 97.5 m (320 ft) long central feeder and eight 21.3 m (70 ft) long branches. The central feeder pipe is 0.3 m (12 in.) diameter vitrified clay pipeline (VCP); the branches are 0.25 m (10 in.) diameter VCP. The crib and tile field are identified with concrete AC-540 monuments and posted with Underground Radioactive Material signs. The crib is delineated with light posts and chain with "Cave-In Potential" signs. The surface is covered with gravel. The depth to the top of contamination is 3 m (10 ft). Located approximately 107 m (350 ft) from the BY Tank Farm tanks and approximately 122 m (400 ft) from the B Tank Farm tanks. Nearest significant structure is the 200-E-45 Shaft that borders the crib.	roughly 1,000 times the amount of plutonium and 5,000 times the fission products that usually would be found in the supernatant discharged to cribs. Acid was added to the crib in an attempt to unplug the crib. The acid did not significantly improve the crib blockage so the tile field was added to receive crib overflow. The site also received the second-cycle waste plus cell drainage stored in Tank 5-6 and other liquid waste from the 221-B Building. The site also received decontamination and cleanup waste generated during the shutdown of 221-B and 224-B. The waste is high in salt, is neutral to basic, and contains transuranic (TRU) constituents and fission materials.	6. Risks are expected to be similar to 216-B-7A Crib; however, because the top of the contamination is about 3 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-7A Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-7A Crib. A much lower relative volume of effluent was sent to the 216-B-8 Crib. Because less volume was discharged to the 216-B-8 Crib, higher inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received less contaminant inventory than the 216-B-7A Crib. In general, the 216-B-8 Crib is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as the 216-B-7A Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-8 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
200-E-45	The 200-E-45 Sampling Shaft is a concrete shaft, 16.6 m (55 ft) deep, constructed of prefabricated concrete sections, 2.4 m (8 ft) in diameter and 1.9 m (6 ft 2 in.) high. Steel pipes were installed laterally through holes in the side of the shaft at 3 m (10 ft) and 6 m (20 ft) from the surface toward the 216-B-8 Crib. The pipes were 15 cm (6 in.) in diameter, and 6.6 m (22 ft) long. The site currently is topped with a large circular cover with a smaller "manhole" entry marked with a	<u>2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream</u> The shaft was used to obtain samples from the 216-B-8 Crib. The bottom of the shaft occasionally collected a significant amount of crib seepage that was pumped out of the shaft and back to the crib. Later the shaft was intermittently filled with water and used as a contaminated pump-testing pit.	The 200-E-45 Sampling Shaft waste site is associated with the 216-B-8 Crib; the shaft was used to collected field readings and data from the 216-B-8 Crib. Therefore, the 200-E-45 Shaft is considered analogous to the 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received overflow from the same waste stream as 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-7A Crib; the 200-E-45 Sampling Shaft is a shaft constructed to monitor crib leakage from the nearby 216-B-8 Crib 3. Waste was received from the same source (221-B and 224-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs)

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	"Confined Space" sign, a hatch, and a vent pipe. The shaft area is surrounded by light duty posts and chain and is posted as a Contamination Area. Nearest significant structure is the adjacent 216-B-8 Crib.		6. Risks are expected to be similar to the 216-B-7A Crib; however, because the top of the contamination could be shallow, human health and ecological risks may be expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders in the shaft may be associated with high contamination at the bottom of the waste site 7. Although the relative effluent volume discharged to this shaft is unknown, contaminant inventory in the vadose zone may pose a threat to groundwater, similar to 216-B-7A Crib, because effluent that had seeped into it from the nearby 216-B-8 Crib dropped directly to the 16.8 m (55-ft) level. Although less volume probably was discharged to the 200-E-45 Sampling Shaft, high inventories could remain in the vadose, posing a threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Assumed to have received less contaminant inventory than the 216-B-7A Crib because contaminants were not intentionally disposed to the shaft in the beginning; contaminants entered the shaft because of overflow from the 216-B-8 Crib. Later the shaft was used for the testing of equipment. In general, the 200-E-45 Sampling Shaft waste site is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as those of the 216-B-7A Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination could be shallower at the 200-E-45 Sampling Shaft, remedial actions also may be needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-9	The 216-B-9 Crib is a 4.3 x 4.3 x 2.4 m (14 x 14 x 8-ft) high wooden structure at the bottom of a 4.7 m (15.5 ft) deep excavation. The tile field, 55.0 x 25.6 m (180 x 84 ft), contains 165 m (540 ft) of 15.2 cm (6 in.) clay tile pipe. Pipes are buried 3.7 m (12 ft) deep at the head and 1.8 m (6 ft) at the other end. Six 18.3 m (60 ft) long lines branch in a chevron pattern from a 54.9 m (180 ft) long central feeder line. Above and below the pipes is 0.5 m (1.5 ft) of gravel. The crib and associated tile field have been surface stabilized and are marked with "Underground Radioactive Material" signs. The crib is located at the south end	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received cell drainage and other liquid waste via Tank 5-6 in the 221-B Building. After the 216-B-361 Settling Tank filled up with sludge, the 216-B-9 Crib was tied directly to the waste lines from the 221-B building and began to serve as both a settling tank and a crib. Sludge accumulated rapidly and waste overflowed to the tile field. The sludge was significantly more concentrated than the tile filed effluent as evidenced by historical scintillation probe profiles of respective monitoring	The 216-B-9 Crib is analogous to the 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to 216-B-7A Crib 3. Waste was received from the same source (221-B and 224-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to the 216-B-7A Crib; however, because the top of the contamination is about 3 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-7A Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-7A Crib. Because less relative volume of effluent was sent to the 216-B-9 Crib, higher inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received less contaminant inventory than the 216-B-7A Crib; even so, groundwater protection is expected to be required. Historical scintillation probe profiles of monitoring wells in the vicinity of the

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	of the posted area. It has a separate posting as a Radioactive Contamination Area and has a "Cave-In Potential" sign. The depthto the top of contamination is 3 m (10 ft). This site is located about 480 m south of the 216-B-7A and 216-B-7Crib and is constructed partly of wooden timbers. *Nearest significant* structure is the 216-B-5Injection Well/Reverse Well located approximately 91m (300 ft) away.	wells. The waste contains TRU and fission products. A soil sample in 1949 showed 1830 µCi/kg of fission products and 14,800,000-dpm alpha. The site received about 36,000,000 liters of liquid process effluent during a period of 3 years (1948-1951).	crib and the tile field indicate substantially more inventory in the crib than in the tile field. In general, the 216-B-9 Crib is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as those of the 216-B-7A Crib, *specifically protection of groundwater and protection against* intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-9 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
UPR-200-E-7	Unplanned Release (site not separately posted or marked, although 216-B-9 Crib is marked with *AC-540 concrete posts*). Located near the 241-B-361 Settling Tank. A cave-in was noted over the underground line near the 241-B-361 Settling Tank, although the exact location cannot be determined. In 1954, the area was covered and marked as an Underground Radioactive Material site, but postings no longer exist at the site. The depth to the top of contamination is unknown and estimated at 0.6 m (2 ft).	<u>2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream</u> *The release consisted* of B Plant cell wash water from the 5-9 Tank. A leak in the underground waste line between the 221-B Building and the 241-B-361 Settling Tank resulted in a maximum dose rate of 1.7 rad/h (1954) at the surface. Approximately 2.8 m^2 (30 ft^2) of soil was contaminated by this release. Top of concentration is near ground surface; it is unknown how deep contamination has reached since 1954 when release occurred.	The UPR-200-E-7 waste site is analogous to 216-B-7A Crib as indicated by location and source of contamination. Because this site was caused by an unplanned release originating from the 216-B-9 Crib, it is also bounded by and analogous to the 216-B-7A Crib. Types of contaminants should be the same as those of the 216-B-9 Crib. Concentrations of contaminants should be less. Contaminant inventory is unknown and was not documented. In general, the UPR-200-E-7 unplanned release is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address direct contact risks to humans and ecological receptors from shallow contamination.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
241-B-361	The 241-B-361 Settling Tank site is a 5.8 m high x 6.1 m diameter (19 ft high x 20 ft diameter), (domed top) settling tank with a capacity of ~136,000 L, and constructed from 15 cm (6-in.) reinforced, pre-stressed concrete. The top of the unit is 1.8 m (6 ft) below grade. Eleven risers are visible above grade; some are blanked off. Delineated with light post and chain, posted with "Underground Radioactive Material" and "Inactive Miscellaneous Underground Storage Tank" signs. Surface is covered with coarse rock. Tank is associated with the 216-B-5 Injection Well/Reverse Well. The depth to the top of the tank is 1.8 m (6 ft).	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The unit received over 3,175,000 L of low-salt alkaline radioactive liquid wastes from cell washings collected in the 5-6W Cells in 221-B and low-level concentrator condensate from the 224-B facility between 1945 and 1947 (active for 2 years). The tank currently contains approximately 78,000 L of black sludge having the consistency of thick pudding with the potential to contain transuranic constituents above 100 nCi/g.	The 241-B-361 Settling Tank is analogous to the 216-B-7A Crib as indicated by waste stream chemistry and the expected distribution of contamination. Radioactive waste from the 221-B and 224-B facilities were accumulated in this tank: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to 216-B-7A Crib in that it was not designed as an unlined near-surface liquid disposal site; instead it was intended to be a process vessel 3. Waste was received from the same source (221-B and 224-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less, because there is no evidence that the tank has leaked 6. Risks are expected to be much less than for the 216-B-7A Crib; however, because the top of the tank is estimated to be less than 3.0 m (10 ft) bgs, human health and ecological risks may be expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination in the tank 7. Contaminant inventory in the vadose zone should not pose a threat to groundwater because there has been no record of leakage. Any contaminants that have leaked are expected to remain in the vadose. Recent spectral gamma logging of two boreholes near this tank did not detect any gamma-emitting radionuclides that would indicate that this tank had leaked (GJO-2002-358-TAC) 8. Generally received lesser contaminant inventory than the 216-B-7A Crib; current tank volume is 83,000 L. In general, the 241-B-361 Settling Tank, particularly any leak from this tank, is analogous to the 216-B-7A Crib. Remedial actions are needed to address the same risks as those of 216-B-7A Crib, specifically protection against intrusion to contaminants in the bottom of the tank which could pose a significant direct contact risk to a potential intruder. Groundwater protection should not be an issue unless tank contents are released to the soil. Because the contamination is shallower at the 241-B-361 Settling Tank, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-5	The 216-T-5 Trench site is a 15.2 x 3.0 x 3.7 m (50 x 10 x 12 ft) deep specific retention trench. The above ground piping was removed and the trench backfilled when the specific retention capacity was reached. Two feet (0.6 m) of clean soil was placed on the trench in 1992. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 91 m (300 ft) from the T Tank Farm tanks and approximately 38 m	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received high-salt neutral/basic liquid second-cycle supernatant waste from the 221-T Canyon Building via Tank 241-T-112. Site received liquid waste in May 1955. Contents have the potential to contain transuranic constituents above 100 nCi/g.	The 216-T-5 Trench is analogous to 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-7A Crib 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to the 216-B-7A Crib; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-7A Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	(125 ft) from the 216-T-32 Crib.		groundwater, similar to the 216-B-7A Crib. Although much less relative volume of effluent was sent to the 216-B-9 Crib, effluent substantially exceeded calculated soil porosity volume. Although less volume was discharged to the 216-T-5 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received equivalent or less contaminant inventory than the 216-B-7A Crib, except for plutonium; even so, groundwater protection is expected to be required. In general, the 216-T-5 Trench is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as those at the 216-B-7A Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-T-5 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-6	The 216-T-6 Crib consists of two 3.7 x 3.7 x 1.2 m (12 x 12 x 4 ft) deep wooden cribs within a 6.1 m (20 ft) deep excavation. One crib overflows into the other. The crib boxes are set 18.9 m (62 ft) apart and are connected in series by a pipe. Above ground piping was removed, all sink holes were filled, and the ground surface was decontaminated and leveled in 1975. The area was surface stabilized and posted as "Underground Radioactive Material" in 1993. The depth to the top of contamination is 7.6 m (25 ft). Isolated from significant structures except the 216-T-3Injection Well/Reverse Well approximately 61 m (200 ft) away.	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The site received low-salt neutral/basic liquid waste from cell drainage from the 221-T Canyon Building and 224-T via the 241-T-361 Settling Tank. Site received liquid waste between August 1946 and October 1947 (active for 1 year). Site has potential to contain transuranic constituents above 100 nCi/g.	The 216-T-6 Crib assembly (two cribs) is analogous to the 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-7A Crib 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to those of the 216-B-7A Crib; however, because the top of the contamination is about 7.6 m (25 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-7A Crib. High inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received equivalent or less contaminant inventory than the 216-B-7A Crib (except for Cs-137) In general, the 216-T-6 Crib is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as those of the 216-B-7A Crib, specifically protection of groundwater and from intruders.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-T-7	The 216-T-7 Crib structure consists of a 3.7 x 3.7 x 2.1 m high (12 x 12 x 7 ft high) wooden crib within a 6.1 m (10 ft) deep excavation and associated tile field. The tile field is a chevron pattern consisting of eight 12.2 m (40 ft) long branches from a 93.0 m (305 ft) long central pipe. The piping is VCP or concrete. Nominal liquid release depth in the tile field was 6.1 m (20 ft). The area was covered with 0.6 m (2 ft) of clean dirt and posted with "Underground Radioactive Material" signs in 1992. The tile field is marked with concrete AC-540 markers. The depth to the top of contamination is 7.6 m (25 ft). Located approximately 36.6 m (120 ft) from the T Tank Farm tanks and adjacent to the 216-T-32 Crib. The crib is within the T Tank Farm fence line; most of the tile field is outside the fence.	<u>2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream</u> The site received high-salt neutral/basic liquid second-cycle supernatant waste from 221-T, 224-T, and tank 5-6 after it cascaded through Tanks 241-T-110, 241-T-111, and 241-T-112. The 216-T-7 Tile Field received overflow from the 216-T-7 Crib. Site received liquid waste from April 1948 to November 1955 (active for seven years).	The 216-T-7 Crib is analogous to the 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-7A Crib 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to the 216-B-7A Crib; however, because the top of the contamination is about 7.6 m (25 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-7A Crib. High inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received equivalent or less contaminant inventory than the 216-B-7A Crib, but did receive more nitrate, supporting the need for groundwater protection In general, the 216-T-7 Crib is analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to protect groundwater and prevent intrusion.
216-T-32	The 216-T-32 Crib structure consists of two 3.7 x 3.7 x 1.2 m high (12 x 12 x 4 ft high) wooden crib boxes, each set into a square bottom pit with sloping sides measuring 20.1 x 4.3 x 7.9 m (66 x 14 x 26 ft). The crib boxes are separated by 12.2 m (40 ft). The crib boxes are connected in series by a pipe, with one crib overflowing into the other. The site was stabilized with gravel, along with the rest of	<u>2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream</u> The site received high-salt neutral/basic liquid waste from 224-T via Tank 241-T-201. The site received liquid waste from November 1946 to May 1952 (active 6 years). Site has the potential to contain transuranic constituents above 100 nCi/g.	The 216-T-32 Crib assembly (two cribs) is analogous to 216-B-7A Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-7A Crib 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to the 216-B-7A Crib; however, because the top of the contamination is about 6.7 m (22 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	T Tank Farm, in 1992. The depth to the top of contamination is 6.7 m (22 ft). Located approximately 27 m (90 ft) from the T Tank Farm and adjacent to the 216-T-7 Crib and tile field.		groundwater, similar to the 216-B-7A Crib. High inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-7A Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-7A Crib 8. Generally received less contaminant inventory than the 216-B-7A Crib; even so, groundwater protection is expected to be required. In general, the 216-T-32 Cribs are analogous to and bounded by the 216-B-7A Crib. Remedial actions are needed to address the same risks as those of the 216-B-7A Crib, specifically protection of groundwater and from intrusion.
241-T-361	The 241-T-361 Settling Tank site is a 5.8 m high x 6.1 m diameter (19 ft high x 20 ft diameter), capacity ~136,000 L (domed top) settling tank that is constructed of 15 cm (6-in.) reinforced, prestressed concrete. The top of the unit is 1.8 m (6 ft) below grade. Posted with "Underground Radioactive Material" and "Inactive Miscellaneous Underground Storage Tank" signs. Surface covered with coarse rock. Tank is associated with the adjacent 216-T-3 Injection Well/Reverse Well. The depth to the top of the tank is 3.7 m (12 ft).	2nd Cycle, Cell 5-6 Drainage, and Lanthanum Fluoride Waste Stream The unit received low-salt alkaline radioactive liquid wastes from cells 5 and 6 in 224-T. Overflow was sent to the 216-T-6 Crib. Site received solid and liquid sludge between 1946 and 1947 (active for 1 year). No liquid is believed to exist in the tank; the sludge is black and has the consistency of axle grease. Tank contents have the potential to contain transuranic constituents above 100 nCi/g.	The 241-T-361 Settling Tank is analogous to the 216-B-7A Crib as indicated by waste stream chemistry and the expected distribution of contamination. Radioactive waste from the 221-B and 224-B facilities were accumulated in this tank: 1. Received a waste stream similar to the 216-B-7A Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to the216-B-7A Crib in that it was not designed as an unlined near-surface liquid disposal site; instead it was intended to be a process vessel 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be considerably less, because there is no evidence that the tank has leaked 6. Risks are expected to be much less than for the 216-B-7A Crib; however, because the top of the tank is estimated to be 1.8 m (6 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders are associated with high contamination in the tank 7. Contaminant inventory in the vadose zone should not pose a threat to groundwater because there has been no record of leakage. Any contaminants that have leaked are expected to be remaining in the vadose soil. 8. Generally received lesser contaminant inventory than the 216-B-7A Crib. In general, the 241-T-361 Settling Tank, particularly any leak from this tank, is analogous to the 216-B-7A Crib. Remedial actions are needed to address the same risks as the 216-B-7A Crib, specifically protection against intrusion to contaminants in the bottom of the tank which could pose a significant direct contact risk to a potential intruder. Groundwater protection should not be an issue unless tank contents are released to the soil. Because the contamination is accessible, remedial actions also may be needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
Representative Site			
216-B-38	The 216-B-38 Trench is an open, unlined trench that is 77 m (250 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep. It was used as a specific retention trench in July 1954. The site was backfilled and stabilized in 1982 with 0.6 m (2 ft) of clean fill. Remedial investigation data suggest that the bottom of the trench is at 4.3 m (14 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream Received high-salt neutral/basic first-cycle supernatant waste from 221-B Building	Investigated in 2001 under DOE/RL-2000-38; results, including risk assessment, reported in DOE-RL-2002-42 and summarized below: • Zone of higher contamination from 14.5 to 40 ft • Maximum concentrations generally from 14.5 to 15.5 ft sample • Maximum Am-241: 43.9 pCi/g at 14.5 to 15.5 ft • Maximum Cs-137: 226,000 pCi at 14.5 to 15.5 ft and 18 to 20.5 ft, decreases an order of magnitude in 22.5- to 25-ft sample and basically not detected at significant concentrations below 54.5 ft • Maximum Pu-238: 7.85 pCi/g at 20 to 31.5 ft • Maximum Pu-23/240: 159 pCi/g at 18 to 20.5 ft • Maximum Sr-90: 2050 pCi at 18 to 20.5 ft • Maximum total uranium: 32.5 mg/kg at 18 to 20.5, above background to 54.5 ft • Maximum U-233/234: 9 pCi/g at 18 to 20.5 ft • Maximum U-238: 6.35 mg/kg at 22.5 to 25 ft • With exceptions noted above, concentrations tend to drop significantly by 40 ft • Technetium-99 (1.9 pCi/g) and tritium (28.7 pCi/g) detected in 52 to 54.5 ft and at lower levels through rest of borehole. Significant human health and ecological risk is associated with Cs-137 and Sr-90 in the 0 to 4.6 m (0 to 15 ft) zone; no chemicals above risk-based standards for human or ecological receptors for direct exposure; groundwater protection concerns for fluoride, nitrate, nitrite, total uranium, U-233/234, and U-238. Geology described in BHI-01607.
200-TW-2 OU analogous wastes sites to be evaluated by the (216-B-38 Trench) model			
216-B-35	The 216-B-35 Trench is an open, unlined trench that is 25 x 3 x 3 m deep (77 x 10 x 10 ft deep). Used as a specific retention trench in July 1954. Site was backfilled and stabilized in 1982 with 0.6 m (2 ft) of clean fill. It was stabilized with top soil, treated with herbicides, and seeded with wheat-grasses. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle waste from 221-B Building. The waste is high in salt and is neutral to basic. Site was active for one month in 1954.	The 216-B-35 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-B-35 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench. In general, the 216-B-35 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as the 216-B-38 Trench, specifically protection of groundwater and protection against

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-B-35 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-36	The 216-B-36 Trench is a 77 x 3 x 3 m (252 x 10 x 10 ft) deep trench that was stabilized in 1982 with 2 ft of topsoil and treated with herbicides and seeded with wheat-grasses. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-B Building. The waste is high in salt and neutral to basic. It was active for one month.	The 216-B-36 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a larger relative volume of effluent was sent to the 216-B-36 Trench, high inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or more contaminant inventory than the 216-B-38 Trench, higher inventories of Cs-137 and nitrate exist at the 216-B-36 Trench; thus groundwater protection and intrusion protection are expected to be required. In general, the 216-B-36 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-B-36 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-37	The 216-B-37 Trench is a 77 x 3 x 3 m (252 x 10 x 10 ft) deep trench that was stabilized in 1982 with 0.6 m (2 ft) of topsoil, treated with herbicides, and seeded with wheat-grasses. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received evaporator bottom waste from the 242-B Waste Evaporator after it had processed B Plant 1st cycle waste. Active for less than one month.	The 216-B-37 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a larger relative volume was discharged to the 216-B-37 Trench, high inventories could remain in the vadose, posing a more significant threat to groundwater than from the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or more contaminant inventory than the 216-B-38 Trench; higher inventories of Tc-99, Cs-137, and nitrate exist at the 216-B-36 Trench; Thus, groundwater and intrusion protection are expected to be required. In general, the 216-B-37 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-B-37 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-39	The 216-B-39 Trench is a 77 x 3 x 3 m (252 x 10 x 10 ft) deep trench that was stabilized in 1982 with 0.6 m (2 ft) of topsoil, treated with herbicides, and seeded with wheat-grasses. The depth to the top of contamination is 4.6 m (15 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-B Building. The waste is high in salt and neutral to basic. Active for one year.	The 216-B-39 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 4.6 m (15 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-B-39 Trench, high inventories

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench. In general, the 216-B-39 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-B-39 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-40	The 216-B-40 Trench is a 77 x 3 x 3 m (252 x 10 x 10 ft) deep trench that was stabilized in 1982 with 0.6 m (2 ft) of topsoil, treated with herbicides, and seeded with wheat-grasses. The depth to the top of contamination is 4.6 m (15 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	<u>Dissolved Cladding and 1st Cycle Waste Stream</u> This site received 1st cycle supernatant waste from 221-B Building. The waste is high in salt and neutral to basic. Active for three months.	The 216-B-40 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; however, because the top of the contamination is about 4.6 m (15 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-B-40 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench . In general, the 216-B-40 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-B-40 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-B-41	The 216-B-41 Trench is a 77 x 3 x 3 m (252 x 10 x 10 ft) deep trench that was stabilized in 1982 with 0.6 m (2 ft) of topsoil, treated with herbicides, and seeded with wheat-grasses. The depth to the top of contamination is 4.6 m (15 ft). Located approximately 80 m (250 ft) from the BX Tank Farm tanks and within the assembly of 216-B-35 through 216-B-42 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-B Building. The waste is high in salt and neutral to basic. Active for less than one month.	The 216-B-41 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received the same waste stream as the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from the same source (221-B) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 4.6 m (15 ft) bgs, human health and ecological risks may be expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-B-41 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at 216-B-38 8. Generally received equivalent contaminant inventory than the 216-B-38 Trench, a higher inventories of Cs-137 exists at the 216-B-36 Trench. In general, the 216-B-41 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination isrelatively shallow at the 216-B-41 Trench, remedial actions may be needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-14	The 216-T-14 Trench is a 83.8 x 3.0 x 3.7 m (275 x 10 x 12 ft) deep trench that was surface stabilized in 1992 with 0.15 to 0.3 m (0.5 to 1 ft) of clean soil. Contaminated soil from the adjacent UPR-200-W-166 was consolidated onto the west slope of the trench. Then the entire grouping of 216-T-14 through 216-T-17 Trenches was covered with another 0.4 to 0.6 m (1.5 to 2 ft) of clean soil. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 4 m	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-104, 241-T-105, and 241-T-106. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for less than one month (January 1954).	The 216-T-14 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-T-14 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	(13 ft). Located approximately 99 m (325 ft) from the T Tank Farm tanks and within the assembly of 216-T-14 through 216-T-17 Trenches.		is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench; thus, groundwater protection is expected to be required. In general, the 216-T-14 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-14 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-15	The 216-T-15 Trench is a 83.8 x 3.0 x 3.7 m (275 x 10 x 12 ft) deep trench that was surface stabilized in 1992 with clean soil as described for the 216-T-14 Trench. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 4 m (13 ft). Located approximately 121 m (400 ft) from the T Tank Farm tanks and within the assembly of 216-T-14 through 216-T-17 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-104, 241-T-105, and 241-T-106. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for two months (January and February 1954).	The 216-T-15 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-T-15 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received contaminant inventory equivalent to the 216-B-38 Trench (Tc-99 and Cs-137 inventories are greater); thus, groundwater protection is expected to be required. In general, the 216-T-15 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-15 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-T-16	The 216-T-16 Trench is a 83.8 x 3.0 x 3.7 m (275 x 10 x 12 ft) deep trench that was surface stabilized in 1992 with clean soil as described for the 216-T-14 Trench. The above ground piping was removed and the unit was backfilled. The depthto the top of contamination is 4 m (13 ft). Located approximately 145 m (475 ft) from the T Tank Farm tanks and within the assembly of 216-T-14 through 216-T-17 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-104, 241-T-105, and 241-T-106. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for less than one month (February 1954).	The 216-T-16 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source (221-T [illegible] 221-B) 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; however, because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-T-16 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench; thus, groundwater protection is expected to be required. In general, the 216-T-16 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-16 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-17	The 216-T-17 Trench is a 83.8 x 3.0 x 3.7 m (275 x 10 x 12 ft) deep trench that was surface stabilized in 1992 with clean soil as described for the 216-T-14 Trench. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 4 m (13 ft). Located approximately 168 m (550 ft) from the T Tank Farm tanks and within the assembly of 216-T-14 through 216-T-17 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-104, 241-T-105, and 241-T-106. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for 5 months (February to June 1954).	The 216-T-17 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 4.0 m (13 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a similar relative volume of effluent was sent to the 216-T-17 Trench, high inventories

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench. In general, the 216-T-17 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-17 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-21	The 216-T-21 Trench is a 73.1 x 3.0 x 3.0 m (240 x 10 x 10 ft) deep trench that was interim stabilized in 1982. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 107 m (350 ft) from the TX Tank Farm tanks and within the assembly of 241-T-21 through 241-T-25 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-109, 241-T-110, and 241-T-111. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for 3 months (June to August 1954).	The 216-T-21 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Although a lesser relative volume of effluent was sent to the 216-T-21 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or less contaminant inventory than the 216-B-38 Trench. In general, the 216-T-21 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-21 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-T-22	The 216-T-22 Trench is a 73.1 x 3.0 x 3.0 m (240 x 10 x 10 ft) deep trench that was interim stabilized in 1982. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 107 m (350 ft) from the TX Tank Farm tanks and within the assembly of 241-T-21 through 241-T-25 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-109, 241-T-110, and 241-T-111. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for 2 months (July to August 1954).	The 216-T-22 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. 8. Generally received equivalent or greater contaminant inventory than the 216-B-38 Trench (higher inventory of Cs-137 exists). In general, the 216-T-22 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-22 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-23	The 216-T-23 Trench is a 73.1 x 3.0 x 3.0 m (240 x 10 x 10 ft) deep trench that was interim stabilized in 1982. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 107 m (350 ft) from the TX Tank Farm tanks and within the assembly of 241-T-21 through 241-T-25 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-109, 241-T-110, and 241-T-111. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for 2 months (July to August 1954).	The 216-T-23 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or greater contaminant inventory than the 216-B-38 Trench (greater inventories of Tc-99 and Cs-137 exist). In general, the 216-T-23 Trench is analogous to and bounded by the 216-B-38

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-23 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-T-24	The 216-T-24 Trench is a 73.1 x 3.0 x 3.0 m (240 x 10 x 10 ft) deep trench that was interim stabilized in 1982. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 107 m (350 ft) from the TX Tank Farm tanks and within the assembly of 241-T-21 through 241-T-25 Trenches.	<u>Dissolved Cladding and 1st Cycle Waste Stream</u> This site received 1st cycle supernatant waste from 221-T Building via Tanks 241-T-109, 241-T-110, and 241-T-111. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for less than one month (August 1954).	The 216-T-24 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. Because a slightly larger relative volume of effluent was sent to the 216-T-24 Trench, high inventories could remain in the vadose, posing a significant threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or greater contaminant inventory than the 216-B-38 Trench (greater inventory Cs-137 exists). In general, the 216-T-24 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-24 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

Table B-2. 200-TW-2 Operable Unit Representative Sites and Associated Analogous Waste Sites. (20 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
216-T-25	The 216-T-25 Trench is a 54.9 x 3.0 x 3.0 m (180 x 10 x 10 ft) deep trench that was interim stabilized in 1982. The above ground piping was removed and the unit was backfilled. The depth to the top of contamination is 3.7 m (12 ft). Located approximately 122 m (400 ft) from the TX Tank Farm tanks and within the assembly of 241-T-21 through 241-T-25 Trenches.	Dissolved Cladding and 1st Cycle Waste Stream This site received evaporator bottoms consisting of sludge from the 242-T Evaporator condensed first-cycle waste. The waste is high in salt and neutral to basic. Received liquid process effluent. Active for less than one month (September 1954).	The 216-T-25 Trench is analogous to the 216-B-38 Trench as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-38 Trench; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-38 Trench 3. Waste was received from a similar source 4. The geology of the two sites is similar, although the vadose zone is thinner in the 200 West Area 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated 6. Risks are expected to be similar to the 216-B-38 Trench; because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-38 Trench 7. The relative effluent volume discharged to this trench suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-38 Trench. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-38 Trench 8. Generally received equivalent or greater contaminant inventory than the 216-B-38 Trench (greater inventories of Tc-99 and Cs-137 exist). In general, the 216-T-25 Trench is analogous to and bounded by the 216-B-38 Trench. Remedial actions are needed to address the same risks as those of the 216-B-38 Trench, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallow at the 216-T-25 Trench, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.

* BHI-01496, *Groundwater/Vadose Zone Integration Project Hanford Soil Inventory Model.*

BHI-01607, *Borehole Summary Report for Boreholes C3103 and C3104, and Drive Casing C3340, C3341, C3342, C3343, and C3344, in the 216-B-38 Trench and 216-B-7A Crib, 200-TW-2 Tank Waste Group Operable Unit.*

DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, Rev. 0.

DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*, Rev. 0.

DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit)*, Rev. 0.

GJO-2002-358-TAC, *Hanford 200 Area Spectral Gamma Baseline Characterization Project, 216-B-5 Injection Well and 216-B-9 Crib and Tile Field Waste Site Summary Report.*

RHO-ST-37, *216-B-5Injection Well/Reverse Well Characterization Study.*

Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
OU = operable unit.
RLS = radionuclide logging system.
TRU = contaminated with 100 nCi/g of transuranic materials with half-lives longer than 20 years.
VCP = vitrified clay pipeline.

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
Representative Site			
216-B-57	The 216-B-57 Crib is a 61 x 4.6 x 3.0 m (200 x 15 x 10 ft) deep excavation that was filled to 1.2 m (4 ft) above the bottom with gravel (approximately 474 m^3 [620 yd^3]). A perforated, 30.5 cm (12-in.) corrugated pipe runs the length of the crib, 0.9 m (3 ft) above the bottom. The side slope of the original crib construction is 1.5:1. The depth to the top of contamination is 12.5 m (41 ft). The crib is covered by the Hanford Barrier, which is an engineered barrier measuring 105 m (320 ft) long, 64 m (210 ft) wide, and 4.6 m (15 ft) high (minimum height). The engineered barrier was constructed on top of the crib in 1994. Located approximately 46 m (150 ft) from the BY Tank Farm tanks.	<u>Process Condensate Waste Stream</u> The site received the waste storage tank condensate from the In Tank Solidification (ITS) #2 Unit in the BY Tank Farm. The site was active from 1968 to 1973 (total of 5 years).	The 216-B-57 Crib was characterized during the 200-BP-1 remedial investigation in 1991 (reported in DOE/RL-92-70). The engineered structure is a gravel crib that received condensate from the ITS #2 Unit in the BY Tank Farm. The contaminant inventory is relatively small. Soil data indicate that contamination is associated with the point of release about 4.6 m (15 ft) below original grade and extends to a depth of about 10.1 m (33 ft), with maximum concentrations of Cs-137 (67,000 pCi/g), Sr-90 (67 pCi/g), Pu-239 (0.01 pCi/g), and Tc-99 (60 pCi/g) detected. Very little contamination is present beyond a depth of 7 m (33 ft) from original grade. The plume geometry and soil characterization data indicate a low potential for groundwater impact from the 216-B-57 Crib. The Hanford Barrier is constructed over this site, which adds approximately 4.6 m (15 ft) to the depth described above.
200-PW-5 OU analogous wastes sites to be evaluated by the (216-B-57 Crib) model			
216-C-6	The 216-C-6 Crib structure is composed of 15 cm (6-in.) diameter galvanized, corrugated, perforated piping placed horizontally 0.3 m (1 ft) above the bottom of the crib (on gravel) to form an "H" structure. It was topped with 1.8 m (6 ft) of gravel and backfill material. The bottom of the crib measured 6.1 m (20 ft) x 3.0 m (10 ft) and was 4.9 m (16 ft) below grade. The depth to the top of	<u>Process Condensate Waste Stream</u> The site received the process condensate from the 201-C Process Building and the 241-CX Vault floor drainage in the 241-CX Area. The waste is acidic. Site received liquid process effluent during 1955 – 1964 (active for 9 years).	The 216-C-6 Crib is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to that of the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-57 Crib 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar site conditions 6. Risks are expected to be similar to the 216-B-57 Crib; however, because the top of the contamination is about 3.0 m (10 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater 8. Generally received equivalent or less contaminant inventory than the 216-B-57 Crib.

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site *Configuration*, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	contamination is 3 m (10 ft). Located approximately 6.1 m (20 ft) from the 241-CX-72 Building (vault containing a tank). Next nearest structure is the 216-C-4 Crib *approximately 43 m* (140 ft) away.		*In general, the 216-C-6 Crib is analogous to and roughly equivalent to the 216-B-*57 Crib. Remedial actions are needed to address the same risks as those of the *216-B-57 Crib, specifically protection of groundwater and protection against* intrusion to contaminants at the bottom of the waste site. Because the contamination *is* shallower at the 216-C-6 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-B-11A and 216-B-11B	The 216-B-11A and 216-B-11B French Drains are constructed of 9.1 m (30 ft) long, 2.4 m (8 ft) diameter corrugated culvert perforated with 2.5 cm (½ in.) diameter holes, buried vertically 3.0 m (10 ft) below grade, and filled with rocks. The sites have the potential for cave-in and are posted with *metal chains and signs.* The depth to the top of *contamination is 7.6 m* (25 ft). Located approximately 61 m (200 ft) from the B Tank Farm tanks and approximately 46 m (150 ft) from the 216-B-7A and 216-B-7B Cribs.	<u>Process Condensate Waste Stream</u> The site received process condensate from the 242-B Evaporator. The waste is low in salt and considered neutral to basic. Site was active from 1951 to 1954.	The 216-B-11A and 216-B-11B French Drains are analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to that of the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Both are unlined liquid disposal waste sites 3. Waste was received from the same source (condensate from 242-B Evaporator) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on *evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50* Cribs) 6. Risks are expected to be similar to the 216-B-57 Crib; however, because the top of the contamination is about 7.6 m (25 ft) bgs, human health and ecological risks are not expected in the 0 to 4.6 m (0 to 15-ft) zone 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater. A greater relative volume of effluent was sent to the 216-B-11A and 216-B-11B French Drains, suggesting that contaminants remaining in the vadose may be deeper than those found in the 216-B-57 Crib, which was found to pose a threat to groundwater. 8. *Generally received equivalent or less contaminant inventory than the 216-B-*57 Crib, supporting the need for groundwater protection at this waste site. In general, the 216-B-11A and 216-B-11B French Drains are analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address the same risks as those of the 216-B-57 Crib, specifically protection of groundwater.
216-B-62	The 216-B-62 Crib has 1.2 m (4 ft) of gravel fill underneath a perforated fiberglass reinforced epoxy pipe. Excavation dimensions are 152.4 m (500 ft) x 3.0 m (10 ft) x ~3.1 m (10 ft) deep. Site surrounded by AC-540 concrete markers and posted as an "Underground Radioactive Material" site. The depth to the top of contamination is *3.7 m* (12 ft).	<u>Process Condensate Waste Stream</u> The site has received process condensate from the 221-B Building Separations Facilities. Received liquid process effluent (radioactive) from 1973 ~ 1991 (active for 18 years).	The 216-B-62 Crib is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-57 Crib; both are unlined liquid *disposal sites* 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on *evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50* Cribs) 6. Risks are expected to be similar to those of the 216-B-57 Crib; however, because the top of the contamination is about 3.7 m (12 ft) bgs, human health and ecological risks are expected in the 0 to 4.6 m (0 to 15-ft) zone; risks to

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	Located more than 300 m (1,000 ft) from any significant structure.		intruders may be associated with high contamination at the bottom of the waste site as evidenced by similar risk at the 216-B-57 Crib 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-57 Crib. A greater relative volume was discharged to the 216-B-62 Crib, suggesting that high inventories could be deeper in the vadose and pose a significant threat to groundwater, similar to the 216-B-57 Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-57 Crib 8. Generally received equivalent contaminant inventory to the 216-B-57 Crib, although the Sr-90 inventory is greater. In general, the 216-B-62 Crib is analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address the same risks as those of the 216-B-57 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90). Because the contamination is shallower at the 216-C-6 Crib, remedial actions also are needed to address human health and ecological risk in the 0 to 4.6 m (0 to 15-ft) bgs zone.
216-S-21	The 216-S-21 Crib site consists of a wooden crib box with two vent risers and one well in the center of the box. The crib structure is 4.9 x 4.5 x 3 m (16 x 15 x 10 ft). Waste site dimensions are 15.2 x 15.4 x 6.4 m (50 x 50 x 21 ft). About 3.0 m (10 ft) of overburden covers the crib. The depth to the top of contamination is 7.3 m (24 ft). Located approximately 137 m (450 ft) from the S Tank Farm tanks and approximately 69 m (225 ft) from the 216-S-4 French Drain.	<u>Tank Condensate Waste Stream</u> The site received 241-SX Tank Farm condensate from the 241-SX-401 Condenser Shielding Building in the SX Tank Farm via Tank 241-SX-206 from 1954 to 1970.	The 216-S-21 Crib is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-57 Crib 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated (e.g., 216-B-43 through 216-B-50 Cribs) 6. Risks are expected to be similar to the 216-B-57 Crib; however, because the top of the contamination is about 7.3 m (24 ft) bgs, human health and ecological risks are not expected 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-57 Crib. A greater relative volume was discharged to the 216-S-21 Crib, suggesting that high inventories could remain in the vadose that pose a significant threat to groundwater, similar to the 216-B-57 Crib. 8. Generally received equivalent or less contaminant inventory than the 216-B-57 Crib. In general, the 216-S-21 Crib is analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address the same risks as those of the 216-B-57 Crib, specifically protection of groundwater and from intrusion.
216-S-9	The 216-S-9 Crib site is a gravel crib measuring 91.5 x 9.1 m (300 x 30 ft) and 7.6 m (25 ft) deep. A U-shaped 15 cm (6-in.) diameter distribution pipe [15 cm (6 in.) diameter, vitrified clay pipe] extends the length of the crib at a depth of approximately	<u>Process Condensate Waste Stream</u> The site has received D-2 tank process condensate from the 202-S Building. The crib received effluent from 1965 to 1969. The waste was composed mainly of nitric acid.	The 216-S-9 Crib is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is similar to the 216-B-57 Crib 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be similar based on evidence from similar sites investigated

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
	6.4 m (21 ft). Waste site dimensions are 15.2 x 15.4 x 6.4 m (50 x 50 x 21 ft). About 3.0 m (10 ft) of overburden covers the crib. The depth to the top of contamination is 7 m (23 ft). Located more than 300 m (1,000 ft) from the SY Tank Farm tanks and approximately 53 m (175 ft) from the 216-S-18 Trench.		6. Risks are expected to be similar to the 216-B-57 Crib; however, because the top of the contamination is about 7.0 m (23 ft) bgs, human health and ecological risks are not expected 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-57 Crib. Although a smaller relative volume was discharged to the 216-S-9 Crib, high inventories could remain in the vadose that pose a significant threat to groundwater, similar to the 216-B-57 Crib. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-57 Crib. Since 1965, monitoring wells have detected radioactive contamination from the crib bottom to the water table. 8. Generally received equivalent or greater contaminant inventory than the 216-B-57 Crib (uranium, plutonium, and Sr-90 inventories are greater). In general, the 216-S-9 Crib is analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address the same risks as those of the 216-B-57 Crib, specifically protection of groundwater and from intrusion.
UPR-200-W-108	The UPR-200-W-108 unplanned release occurred during the tie-in of the 216-S-9 Crib to the 216-S-23 Crib. The release occurred in an excavation at a depth of 6.1 m (20 ft). The depthto the top of contamination is 0.6 m (2 ft). Located adjacent to the 216-S-9 Crib.	Process Condensate Waste Stream The release was documented on January 8, 1969. Approximately 114 L (30 gal) of D-2 tank process condensate from the 202-S Building was released.	The UPR-200-W-108 unplanned release is analogous to the 216-B-57 Crib based on the source of contamination (216-S-9 Crib). This unplanned release area resulted from a break in a line used to transfer waste liquid from the 216-S-9 Crib to the 216-S-23 Crib and a subsequent spill of approximately 114 L of liquid waste. It is analogous to the 216-B-57 Crib based on its relationship with the 216-S-9 Crib. The UPR-200-W-108 unplanned release is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to the 216-B-57 Crib in that it was a spill rather than a liquid disposal site 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less based on the limited quantity of the spill 6. Risks are expected to be similar to those of the 216-B-57 Crib with respect to human health and ecological risks, because the contamination is near the surface - 0.6 m (2 ft) 7. The volume of effluent spilled suggests that groundwater should not be impacted 8. Generally received lesser contaminant inventory than the 216-B-57 Crib. In general, the UPR-200-W-108 unplanned release is analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address some of the same risks as those of the 216-B-57 Crib, specifically protection for human and ecological receptors from shallow contamination.

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
UPR-200-W-109	The UPR-200-W-109 unplanned release occurred during the tie-in of the 216-S-9 Crib to the 216-S-23 Crib. The release occurred within an open excavation. The dimensions of the release were not documented. The depth to the top of contamination is 0.6 m (2 ft). Isolated release approximately 107 m (350 ft) from the UPR-200-W-108 unplanned release (and just inside the 218-W-9 Burial Ground boundary).	Process Condensate Waste Stream The release was documented on January 24, 1969. However, the quantity of the release was not documented. The effluent contained D-2 tank process condensate from the 202-S Building.	The UPR-200-W-109 unplanned release is analogous to the 216-B-57 Crib based on the source of contamination (216-S-9 Crib). This unplanned release area resulted from a break in a line used to transfer waste liquid from the 216-S-9 Crib to the 216-S-23 Crib subsequent to the UPR-200-W-108 unplanned release. The amount of liquid waste spilled is unknown. It is analogous to the 216-B-57 Crib based on its relationship with the 216-S-9 Crib. The UPR-200-W-108 unplanned release is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and expected nature and vertical extent of contamination: 1. Received a waste stream similar to the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is not similar to the 216-B-57 Crib in that it was a spill rather than a liquid disposal site 3. Waste was received from a similar source 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is expected to be considerably less based on the limited quantity of the spill 6. Risks are expected to be similar to those of the 216-B-57 Crib with respect to human health and ecological risks, because the contamination is near the surface - 0.6 m (2 ft) 7. The volume of effluent spilled suggests that groundwater should not be impacted 8. Generally received lesser contaminant inventory than the 216-B-57 Crib. In general, the UPR-200-W-109 unplanned release is analogous to and roughly equivalent to the 216-B-57 Crib. Remedial actions are needed to address the some of the same risks as those of the 216-B-57 Crib, specifically protection for human and ecological receptors from shallow contamination.
The following sites are within the 200-PW-5 OU and analogous to the 216-B-57 Crib; however, sufficient information is available for stand-alone characterization.			
216-B-50	The 216-B-50 Crib site is a gravel crib with a bottom surface measuring 9.1 x 9.1 m (30 x 30 ft) that is 4.3 m (14 ft) below grade. The crib has been stabilized with gravel, is surrounded with light chain, and is posted as an "Underground Radioactive Material" area. The depth to the top of contamination is 4.6 m (15 ft). Located approximately 137 m (450 ft) from the BY Tank Farm tanks and associated with the assembly of 216-B-43 through 216-B-50 Cribs.	Tank Condensate Waste Stream The site received waste storage tank intermediate-level process condensate from the ITS #1 Unit in the BY Tank Farm from 1965 – 1974 (active for nine years).	The 216-B-50 Crib is analogous to the 216-B-57 Crib as indicated by process history, contaminant inventory, effluent volume received, and sampling data collected under DOE/RL-88-32 and reported in DOE/RL-92-70; a risk assessment is provided in Appendix C of this feasibility study: 1. Received the same waste stream as the 216-B-57 Crib; therefore, the contaminant types are expected to be very similar 2. Site construction is the same as the 216-B-57 Crib 3. Waste was received from the same source (221-U) 4. Both sites are located in the 200 East Area in proximity to each other; the geology of the two sites is similar 5. The vertical extent of contamination is similar based on characterization evidence from this site; contaminants were found mainly in a zone from 5.6 to 9.8 m (18.5 to 32 ft) bgs (this was a shallow borehole; based on the 216-B-49 Crib, which was drilled to the water table as representative of the deep zone for the other sites in the 216-B-43 through 216-B-50 series of cribs, this zone would be expected to be about 15 m (50 ft) bgs; Tc-99 and nitrate are expected to be found throughout the vadose zone 6. Risks are similar to those of the 216-B-57 Crib; because the top of the contamination is about 4.6 m (15 ft) bgs, direct contact human health risk and ecological risk are not anticipated; intruder risk is a concern 7. The relative effluent volume discharged to this crib suggests that contaminant inventory in the vadose zone may pose a threat to groundwater, similar to the 216-B-57 Crib. About one-third of the relative volume of effluent was sent to the 216-B-43 Crib; this suggests that contaminants remaining in the vadose may not have been flushed through the crib, and concentrations may exceed

Table B-3. 200-PW-5 Operable Unit Representative Sites and Associated Analogous Waste Sites. (6 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site Discharge History (WIDS)	Rationale
			those found in the 216-B-57 Crib, which was found to pose a threat to groundwater. This implies that groundwater protection is needed at this waste site, as it is at the 216-B-57 Crib 8. Generally received equivalent contaminant inventory than the 216-B-57 Crib. In general, the 216-B-50 Crib is analogous to the 216-B-57 Crib. Remedial actions are needed to address the same risks as those for the 216-B-57 Crib, specifically protection of groundwater and protection against intrusion to contaminants at the bottom of the waste site, which could pose a significant direct contact risk to a potential intruder because of the nature of the contaminants (i.e., Cs-137 and Sr-90).

DOE/RL-88-32, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-1 Operable Unit, Hanford Site, Richland, Washington*, Rev. 1.
DOE/RL-92-70, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit*, Vols. 1 and 2, Rev. 0.
DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, Rev. 0.
* PNNL-11800, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*.
Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
ITS = in-tank solidification.
OU = operable unit.
WIDS = *Waste Information Data System Report*.

Table B-4. Depth to Top of Contamination at the Waste Sites.

200-TW-1 Operable Unit		200-TW-2 Operable Unit		200-PW-5 Operable Unit	
Waste Site	Depth to Top of Contamination (ft)	Waste Site	Depth to Top of Contamination (ft)	Waste Site	Depth to Top of Contamination (ft)
200-E-14	7 (top of tank)	200-E-45	10	216-B-11A&B	25 ft
200-E-114	10	216-B-5	243	216-B-50	15
216-B-14	10	216-B-7A&B	18	216-B-57	41
216-B-15	13	216-B-8	10	216-B-62	12
216-B-16	10	216-B-9	10	216-C-6	10
216-B-17	11	216-B-35	12	216-S-9	23
216-B-18	11	216-B-36	12	216-S-21	24
216-B-19	13	216-B-37	12	UPR-200-W-108	2
216-B-20	12	216-B-38	14	UPR-200-W-109	2
216-B-21	12	216-B-39	15		
216-B-22	12	216-B-40	15		
216-B-23	19	216-B-41	15		
216-B-24	19	216-T-3	15		
216-B-25	19	216-T-5	12?		
216-B-26	12*	216-T-6	25		
216-B-27	18	216-T-7	25		
216-B-28	12	216-T-14	13		
216-B-29	12	216-T-15	13		
216-B-30	12	216-T-16	13		
216-B-31	13	216-T-17	13		
216-B-32	13	216-T-21	12		
216-B-33	13	216-T-22	12		
216-B-34	13	216-T-23	12		
216-B-42	10	216-T-24	12		
216-B-43	18	216-T-25	12		
216-B-44	18	216-T-32	22		
216-B-45	17	241-B-361	6 (top of tank)		
216-B-46	18	241-T-361	6 (top of tank)		
216-B-47	21	UPR-200-E-7	17		
216-B-48	17.5				
216-B-49	16.5				
216-B-51	13				
216-B-52	12				
216-BY-201	5				
216-T-18	12				
216-T-26	18				
UPR-200-E-9	10				
216-B-58	8				
216-B-53A	10				
216-B-53B	10				
216-B-54	8				

*WIDS data indicate 19 ft but site sampling found contamination at 13 ft.